THE MODEL ENGINEER

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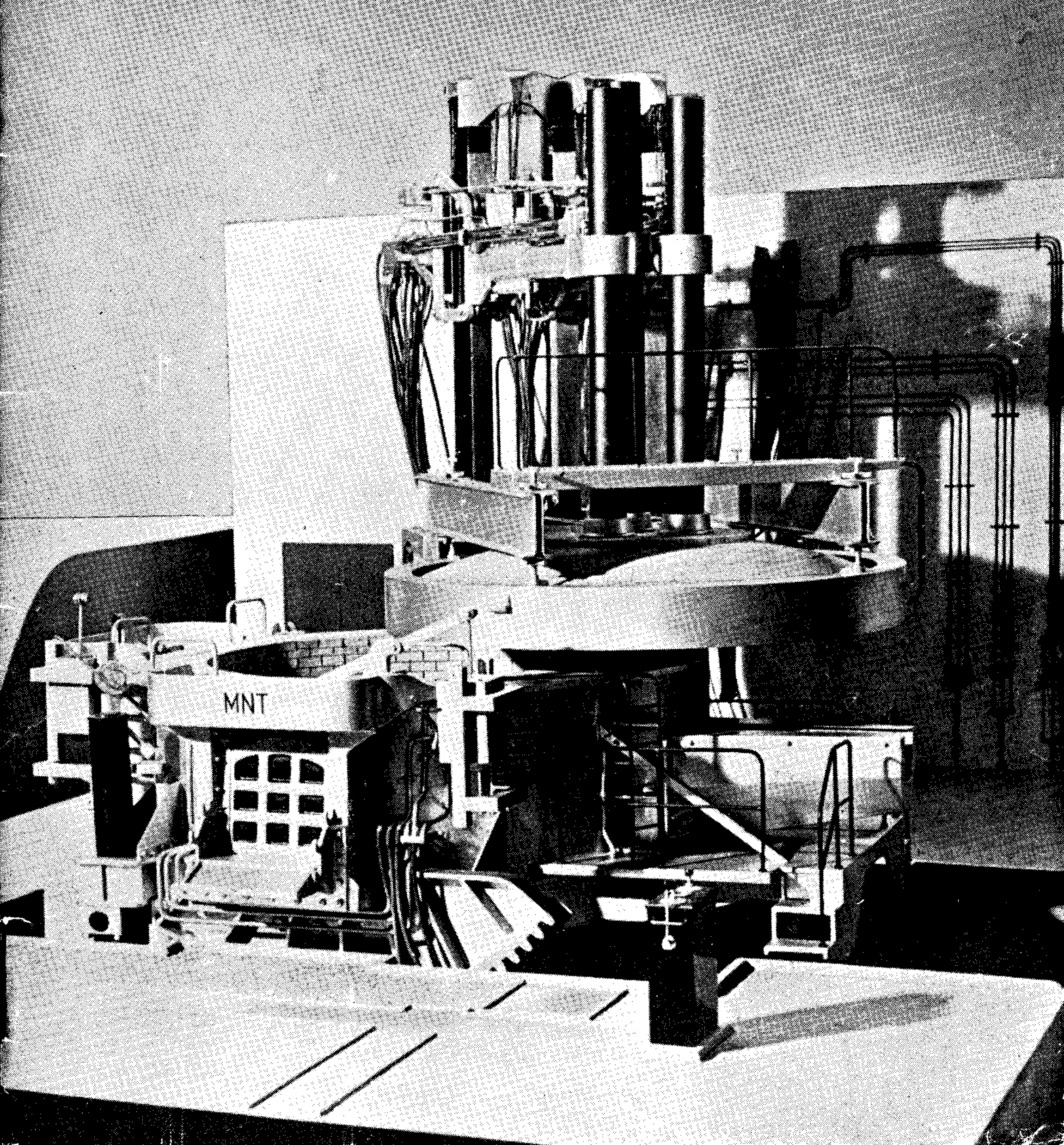


The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

7TH APRIL 1949 VOL. 100 NO. 2498

SMOKE RINGS

Our Cover Picture

● MODELS FOR exhibition and demonstration at Trade Fairs and the like are becoming extremely popular, and there is no doubt that, to the layman as well as to the technical expert, they are useful and fascinating. One of the latest examples is illustrated on our cover this week; it was constructed by Messrs. L. W. Jones, of Smethwick, to the order of Messrs. Birlec, of Birmingham, and is complete to the smallest detail. To the scale of 1 in. to 1 ft., the model represents a Birlec direct-arc steel-melting furnace and is of composite construction, the 16-in. diameter bowl being built of segmented blocks of wood, glued and screwed before final turning. The doorways and pourer are also of wood.

The electrode gear is of metal, the electrodes being of copper tubing, as in the original. The lid, and lift casting are built of brass, while the carriage columns are made in mild-steel plate.

The inside bowl, cupola dome, and pourer are lined with imitation firebrick material. The centre furnace swings on two toothed quadrants built up of brass plate, dowelled and sweated, the toothed portion being formed round from $1\frac{1}{4}$-in. square brass bar. Mounted on a faceplate, this was turned to section, and milled 10-tooth profile with a home-made cutter.

The base, containing the mechanism is framed in oak, and covered with plywood, finished concrete. A screw jack operated through bevels raises the lifting ram, which has five wedge faces at its end; these engage in a recess in the lift casting which raises the lid from the bowl. An arm operating through a slot in the base swings the entire assembly through 90 deg. for top charging.

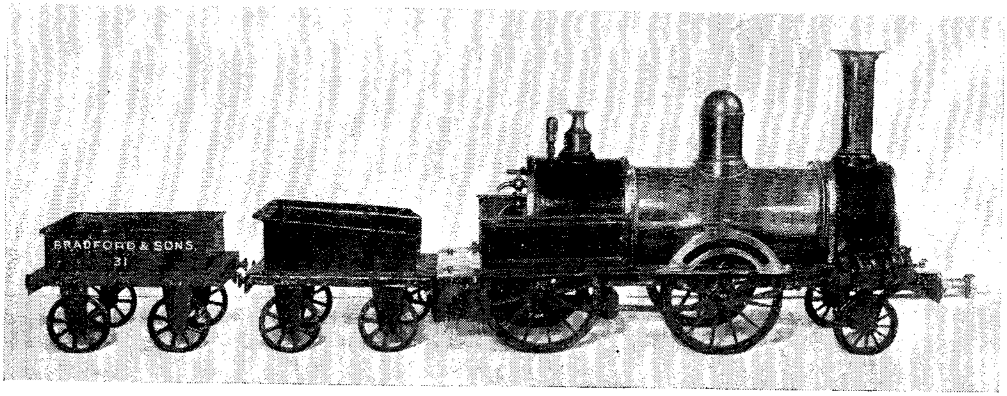
Tilting in either direction is effected by wire cables, operated by a screw controlled draw-bar, working up through the telescopic tilting rams. The back wall is complete with L.T. outlets, sub-station panels, switchboard, clocks, compressed air, and water services.

Mr. M. P. Polson, A.S.E.

● WE CONGRATULATE Mr. M. P. Polson, Chairman of the Bombay Society of Model Engineers, upon his election as an Associate of the Society of Engineers. We understand that this distinction is due to the services which Mr. Polson has rendered to the youths of India, irrespective of their caste, creed or colour, by giving them an opportunity to interest themselves in their leisure and develop craftsmanship which may prove to be a turning-point in their careers. The circumstances in which Mr. Polson carries on his good work are probably more difficult than any found in Britain.

"A Centenarian"

● WE WOULD like to thank the numerous readers who have written to us with reference to the old model locomotive described and illustrated under the above title in our issue for March 10th. There can be little doubt that the boiler was fired by means of a red-hot bar of iron ; several of our correspondents seem to have been familiar with this crude method of firing.



But Mr. W. Dendy, of Sutton, has sent us some photographs of another old engine that he found in a coal-merchant's office at Eastbourne. We reproduce one of the photographs herewith, and a study of it can scarcely fail to suggest that, in spite of the engine being of very different type, it is the work of the same craftsman who built Dr. Bunyan's engine. The boiler is of the same type and is arranged for the same method of firing ; the chimney is identical with the other, but the dome casing, while it is exactly similar in the size and shape of its upper part, has a round instead of a square base.

The wheels of the Eastbourne engine, however, are quite different and do not appear to be sprung ; in fact the engine seems to be of cheaper construction, an idea which is supported by the rather ridiculous tender and wagon !

The Beaufoy Institute M.E. Club

● IN OUR issue for March 3rd, our "Club Announcements" columns contained, we believe for the first time, a notice sent to us by Mr. A. Tasker, hon. secretary of the above club. Brief details were given of the facilities available, and there was a cordial invitation to new members to make use of them.

We have now received a letter from Mr. J. Girdler, of London, S.W.2, who expresses satisfaction with his experience of the club ; he writes :—" You will know only too well that the greatest handicap to the model engineer is lack of workshop space and facilities for getting on with the particular job that has captured his imagination. There can be no doubt that many a fine model has never been commenced owing to this great obstacle between the budding constructor and the completion of a job to his satisfaction . . . I found myself baulked in the same manner, until I read the notes of the Beaufoy Institute M.E. Club in your paper . . . As a result of a personal call and a net outlay of two shillings and threepence, I have enrolled for the remainder of the season."

Mr. Girdler then enumerates the comprehensive equipment and facilities available, and remarks that they are " literally a model engineer's paradise." We hope that he will soon have produced the models he seems so anxious to build ; and, in the meantime, we are glad to pass on to our readers the information he has so kindly sent us, as we feel sure that there may be others who could avail themselves of the facilities which the Beaufoy Institute M.E. Club can offer. Its address is 39, Black Prince Road, London, S.E.11.

To "M.E." Exhibition Exhibitors

● PLANS FOR this year's "M.E." Exhibition are already well in hand, and entry forms are now being sent out ; in fact, many have been despatched to potential exhibitors. This year, we extend an invitation to each exhibitor to send in an article describing his exhibit and giving interesting details of its history ; that is to say, the reason behind its building, together with particulars of any difficulties met with and overcome during construction, as well as any information regarding special processes made use of.

The articles should be illustrated by good photographs printed on glossy paper, while drawings may be used to show details of any special feature.

Any such articles published in the "M.E." will, of course, be paid for at our standard rates.

The Society of Inventors

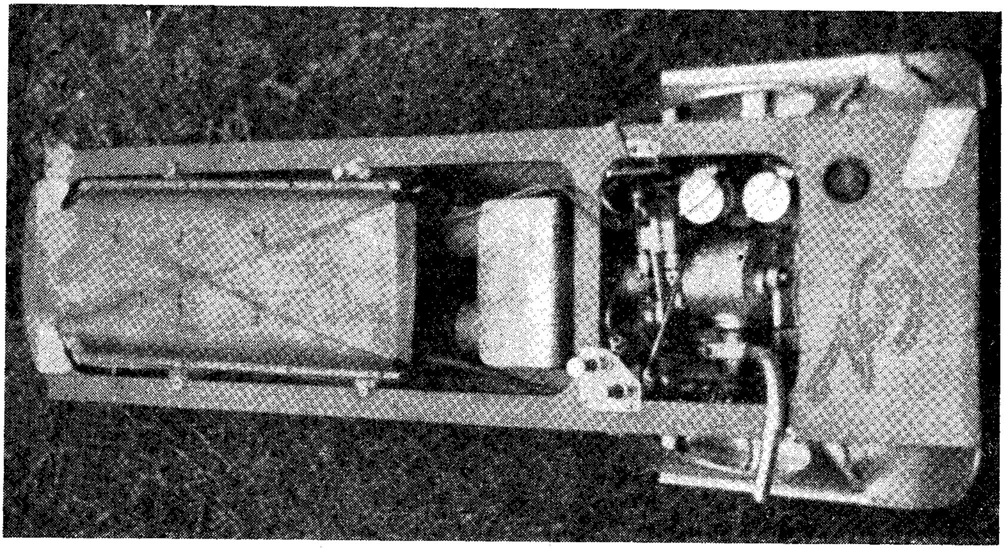
● AN EXHIBITION of inventions and other mechanical phenomena has been organised by the above society and will be held at the Chorlton Town Hall, All Saints, Manchester, on July 1st and 2nd next. If any reader possesses what he thinks is an appropriate exhibit, he is invited to get into touch with the Exhibition Secretary, Mr. F. W. Rutten, 4, Westgate Gardens, Royal Oak Estate, Northenden, Manchester. Medals and other prizes will be awarded to the best exhibits.

"VESTA II"

A "B" Class Flash Steam Hydroplane

by F. Jutton

THIS craft is the outcome of three seasons' development. The original engine was a $\frac{5}{8}$ in. × $\frac{3}{4}$ in. flat twin, with a single rotary valve feeding both cylinders. The performance of this engine was quite good but its mechanical reliability left much to be desired. A single-



The flash-steam hydroplane, "Vesta II," from above

cylinder, piston-valve engine was, therefore, started upon, and was fitted to the original hull early in the 1947 season. This engine has run up to the end of the 1948 season with very little trouble ; two stripped pump drive gears (a wider gear is now fitted) and two new valve drive crank ball-races being the only replacements, due to wear.

The first two seasons' developments were carried out with another flash-steam enthusiast, Mr. B. Pillenor, the owner of the "A" class hydroplane, *Ginger*. It is a big advantage if two boats, especially flash-steamers, can be developed together, as both can benefit from unsuccessful as well as from successful experiments. Trouble has been experienced at the end of the 1948 season with "flipping," a fault not uncommon to surface planing craft. This spectacular but useless finish to a run occurs between 40 and 45 m.p.h., according to conditions. No cure has yet been found for this ; it has not yet been proved whether the fault lies with plane angles or front hull shape.

On rare occasions, the boat has stood on its tail, returned to an even keel and completed its run, but as this performance cannot be relied upon, a way must be found of keeping the boat down to its natural element.

The Engine

The engine is almost without alteration from its first appearance, the only modifications being an extra pump for blowlamp feed, and a wider pump drive gear. It is of the single-acting type, $\frac{7}{8}$ in. bore × $\frac{7}{8}$ in. stroke, with piston-valve, driven by a slotted return crank. The return crank centre is offset 5/32 in. from main crank centre, and this gives a variable speed valve drive, improving valve-timing by accelerating the valve over the inlet period, allowing a wider port opening than usual, together with an early cut-off. The valve is of cast-iron with a steel end and the valve chest is nickel-steel brazed into the steel cylinder-head.

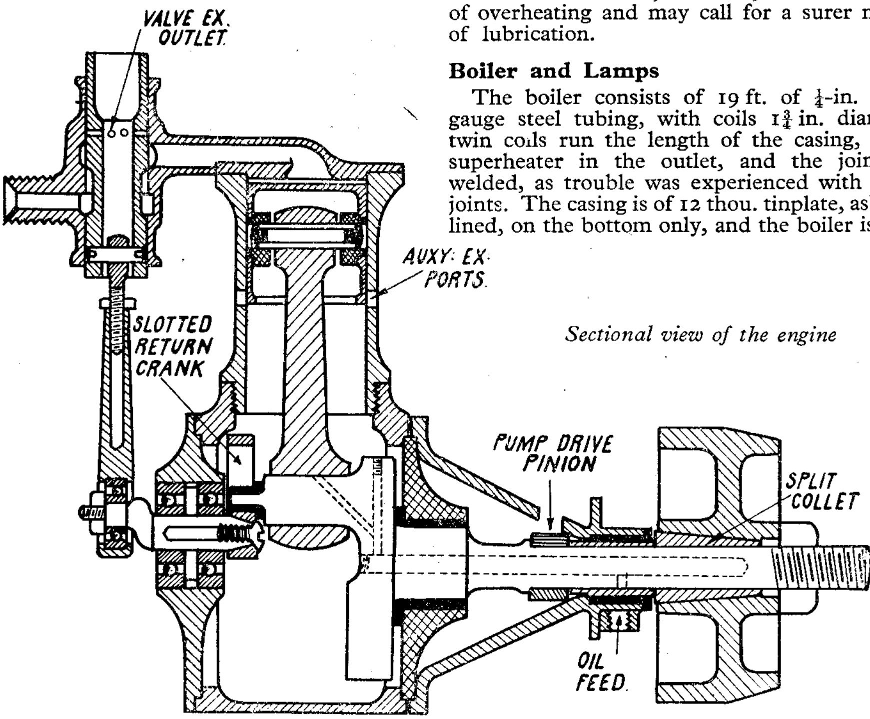
The cylinder is cast-iron screwed into the dural crankcase, and the piston is silver-steel, a lapped fit, with brazed-in gudgeon-pin bosses. Connecting-rod is of "H" section dural, unbushed. The crankshaft is machined from H.T. steel, with $\frac{3}{8}$ in. diameter crankpin ; main bearings are, inner $\frac{1}{2}$ in. diameter, outer $\frac{3}{8}$ in., and the shaft

is screwed $\frac{5}{16}$ in. B.S.F.; no hardening process is carried out. The pump drive pinion was originally cut on the shaft, but when the wider pump drive gear was fitted, a pressed-on pinion took its place. Main bearing bushes are phosphor-bronze, pressure-fed. The pump drive and pump mounting is fixed to the small end of the tapered rear crankcase housing, and drives from the crankshaft pinion through a slot in the housing.

placement, a piston and cup-leather washer separating oil and water in the oil containers. Adjustable needle-valves are fitted to control oil supply. Separate containers are used for steam and lubricating oil, bearing feed is to rear main bearing, via hollow crankshaft to front main and big-end. The valve drive shaft runs on ball-races and requires only splash. The small squared bronze bush that slides in the slotted return crank, however, has shown signs of overheating and may call for a surer method of lubrication.

Boiler and Lamps

The boiler consists of 19 ft. of $\frac{1}{4}$-in. $\times$ 23-gauge steel tubing, with coils $1\frac{3}{4}$ in. diameter; twin coils run the length of the casing, with a superheater in the outlet, and the joints are welded, as trouble was experienced with brazed joints. The casing is of 12 thou. tinplate, asbestos-lined, on the bottom only, and the boiler is wired



Sectional view of the engine

The flywheel is secured by a split tapered sleeve, which is extended to form the rear main bearing surface. All crankcase joints are spigoted and secured by 6-B.A. set-screws. No castings were used in the construction, all light alloy parts being machined from dural bar.

Pumps and Lubrication

The fuel and water pumps are driven by a spur gear at 4 to 1 reduction, and are mounted side by side on the rear end of the crankcase housing. The pump drive shaft runs in ball-races pressed into eccentric housings; this gives an adjustment for mesh. Water pump stroke is adjustable from $\frac{3}{16}$ in. to $\frac{7}{16}$ in. by a series of holes in the driving disc; the bore is 7/32 in. Fuel pump stroke is adjustable from $\frac{3}{16}$ in. to $\frac{5}{16}$ in. by changing the driving eccentric; the bore is 5/32 in. Both pumps have stainless steel rams, $\frac{1}{8}$ in. stainless ball-valves and phosphor-bronze valve bodies. The water pump body is of dural, but the fuel pump body is of phosphor-bronze, as it was found that petrol did not suit dural as a lubricant.

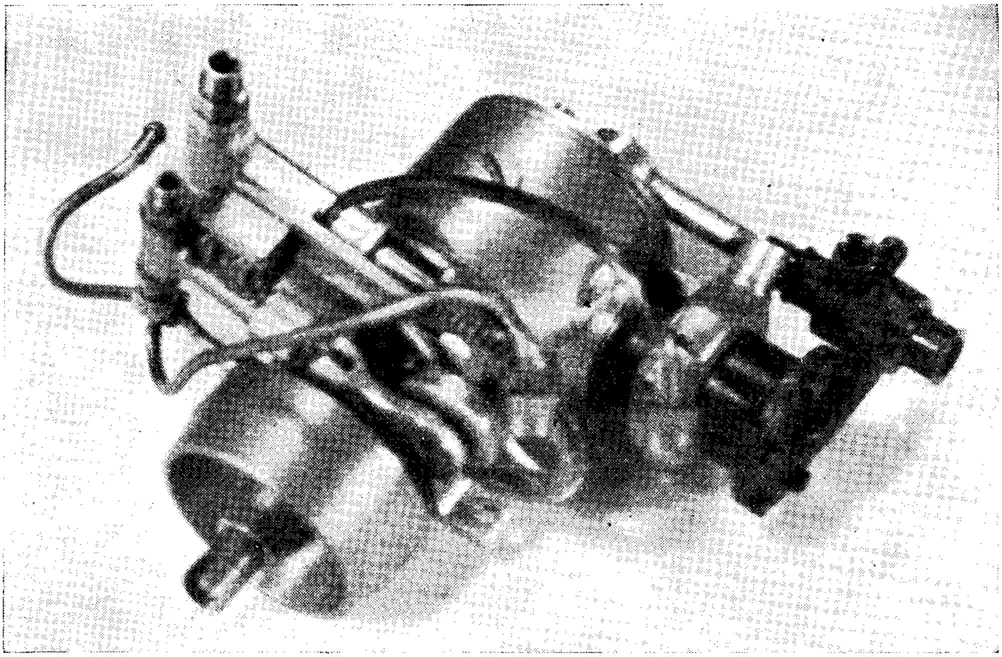
Bearing and valve chest lubrication is by dis-

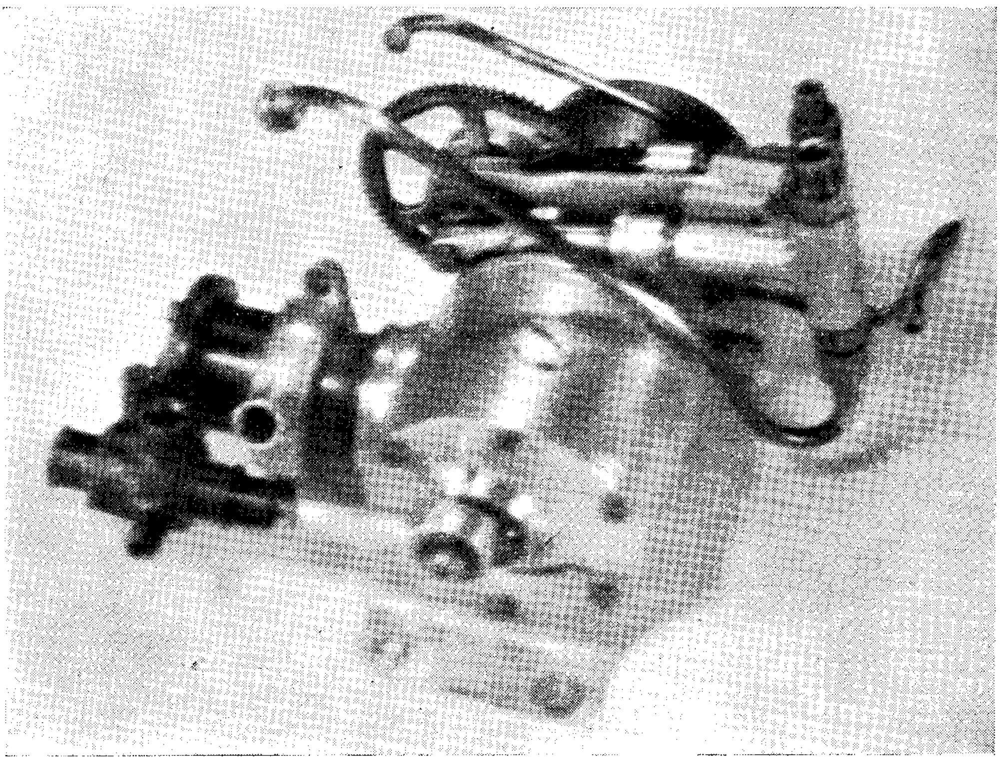
in position to the top half of the casing, the bottom half being attached to the deck stringers.

The twin blowlamps have flame tubes $1\frac{7}{8}$ in. diameter $\times$ 4 in. long, three turns of $\frac{3}{16}$ in. $\times$ 18-gauge steel tube, inside the flame tubes form the vaporising coils. Jets are motor-cycle carburettor main jets, which are obtainable in a variety of sizes; the present jets are No. 60. There is no adjustment on the jets, the fuel pump stroke and jet sizes being altered to control the flame. The fuel tank, not having to withstand pressure, is made from 6 thou. brass foil; it is 2 in. diameter $\times$ $5\frac{1}{2}$ in. long and is housed in the nose of the hull.

Hull

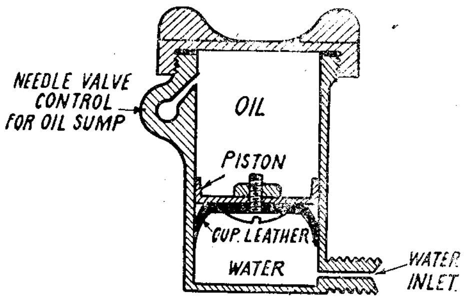
The original hull of *Vesta* was a normal, single-step, hydroplane, but due to reasons known only to itself, it was very unstable at speeds over 30 m.p.h. At the close of the 1947 season, experiments were carried out with surface planing, and the results were such that the hull for *Vesta II* was made with no step, and intended for further experiments in surface planing.





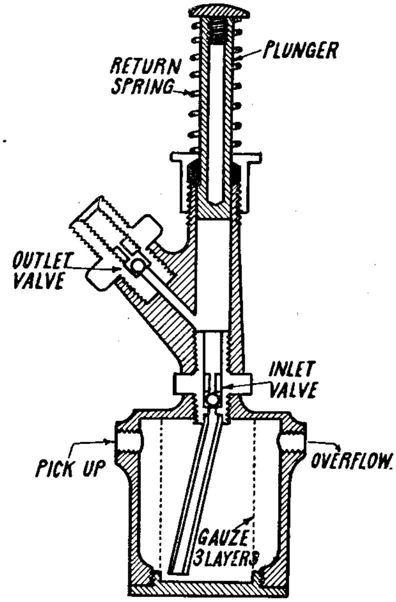
Two views of the engine, from above

The present hull is 30 in. long, 8 in. beam and 3 in. maximum depth. Two main ash spars run the length of the hull, and carry engine mountings and skeg fixing; four formers of $\frac{1}{8}$ in. 3-ply carry the $\frac{1}{4}$ in. × $\frac{1}{4}$ in. spruce stringers, and the nose-piece is carved from mahogany. The frame was made up and finished before covering; the floor of 3/64 in. three-ply, was then fixed, followed by the sides of 1/32 in. three-ply. The inside was then varnished before fitting the deck. The skin was cut to size, plus $\frac{1}{8}$ in. all round, and brass-pinned and glued, the pins being clinched inside. Four coats of varnish were applied, each being rubbed down prior to adding the following coat. The varnish used was "Corrux" marine finish yacht varnish, and so far this has withstood all assaults by oil and petrol. Silk tape was varnished at intervals along inside corners and on the nose outside to add strength at these points.

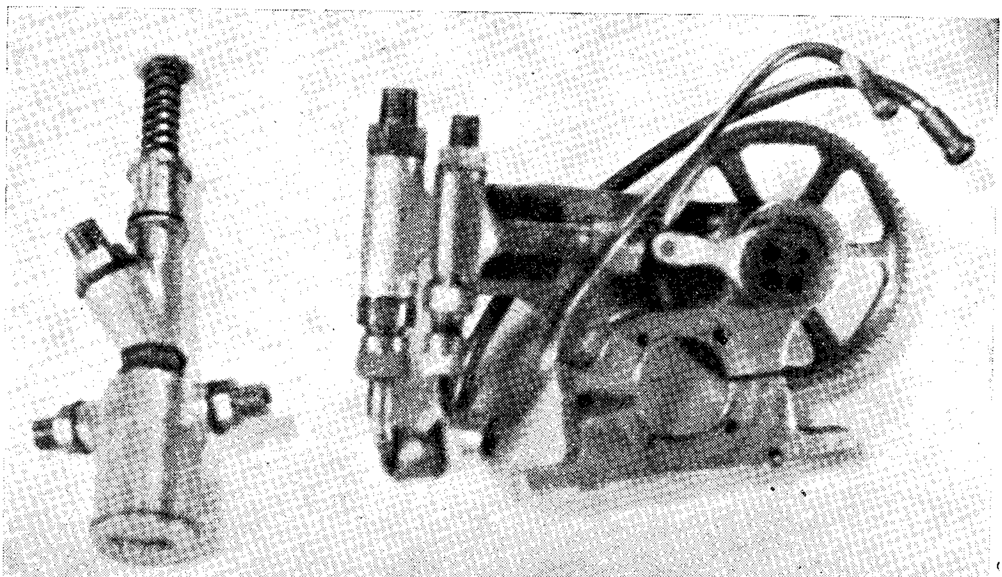


Section of the displacement oil feed container

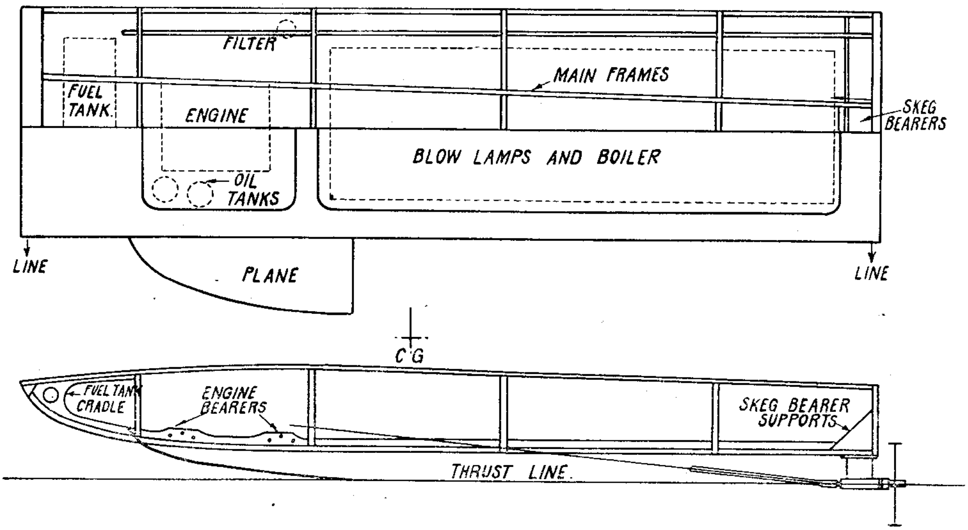
The present planes are fitted to allow for adjustment of angle, the most successful of which to date are of flat dural, $2\frac{1}{4}$ in. wide, 8 in. long, set at an angle of 1 in 14 at rear, increasing to 1 in 3 at the front end. The centre of gravity is $1\frac{1}{2}$ in. aft of the rear of the planes. A two-point attachment bridle is used, the tethering points being at the extreme front and rear of the hull.



The pick-up filter, water reserve tank and hand pump



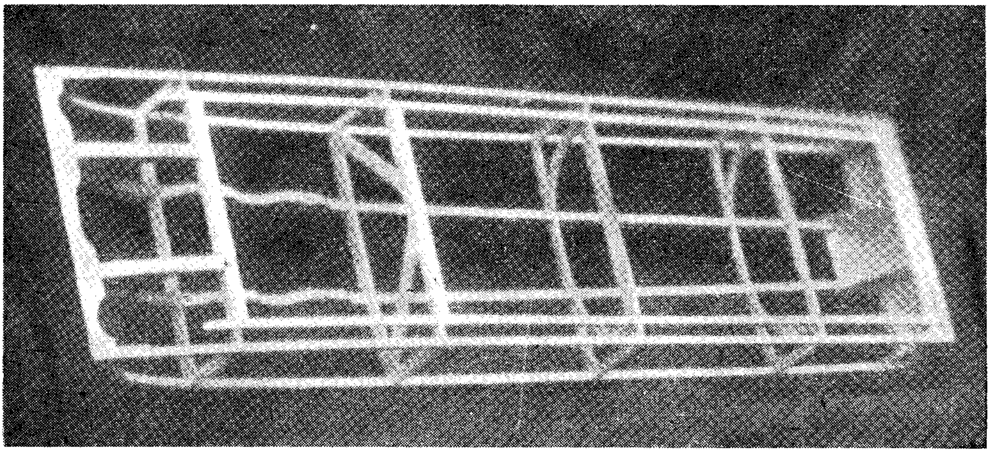
The hand pump, engine pumps and drive assembly



Half sectional plan, half plan and sectional elevation of the hull

Fittings

The two hand-pumps are of the plunger type, $\frac{1}{4}$ in. bore × $\frac{3}{4}$ in. stroke and identical. They are mounted side by side on the outer edge of the hull, and operated by thumb pressure. The combined filter and pick-up reservoir is screwed direct on to the hand water pump. Pump and filter bodies are made of dural. The soapy growth encountered when using dural for water fittings has caused no trouble, due, perhaps, to regular cleaning and emptying of water at frequent intervals. The knock-off switch operates a ball-valve release at the water end of the boiler; the blowlamps die out automatically as the engine pump stops. The propeller shaft is $\frac{3}{16}$ in. stainless-steel, with ball and pin universal joints. The skeg is brazed up from 3/32-in. mild-steel plate and has "Tufnol" bushes pressed into a housing. The propellers are cut from solid dural, by hand, and pitched on a gauge described in THE MODEL ENGINEER, Volume 69, No. 1697, November 16th, 1933. Propellers of this type have been used throughout 1948 without trouble, two brazed-up steel ones having failed, probably due to the bouncing of the hull. The most successful one has been of normal shape, $3\frac{1}{4}$ in. dia., 8 in. pitch, the blade area being made slightly larger than a former submerged propeller.



The framework of the hull.

IN THE WORKSHOP

by "Duplex"

*34—Additions to Machine Tools

(2) An Adjustable Index and Long Handle for the Cross-Slide of the Myford ML7 Lathe

IN the days before it became the general practice to furnish the lathe cross-slide with a graduated index, it was customary when taking a cut along the work to mark the position of the feed handle with a chalk line, and for the following cut this line was rubbed out and a fresh chalk mark put on to denote the new setting. Later, a further advance was to make the index adjustable so that at the start of the turning operation it could be set to the zero position, thus greatly facilitating the turning of parts to an exact diameter without having to make a calculation, or needing to bear in mind the number indicating the initial setting. Again, when cutting threads, the dial can be set to zero as representing the outside diameter of the work, and it is then only necessary to feed the tool inwards for the known depth of the thread to obtain the desired result; furthermore, should the operation be interrupted, the dial alone will indicate exactly the progress of the work and what machining remains to be done.

Although the fitting of feedscrew indexes has been described in a previous article, so many requests have been received from less experienced workers for detailed explanations for equipping various makes of lathes, that an account of the methods we have adopted in the case of a representative lathe like the ML 7 will no doubt be of interest to many readers.

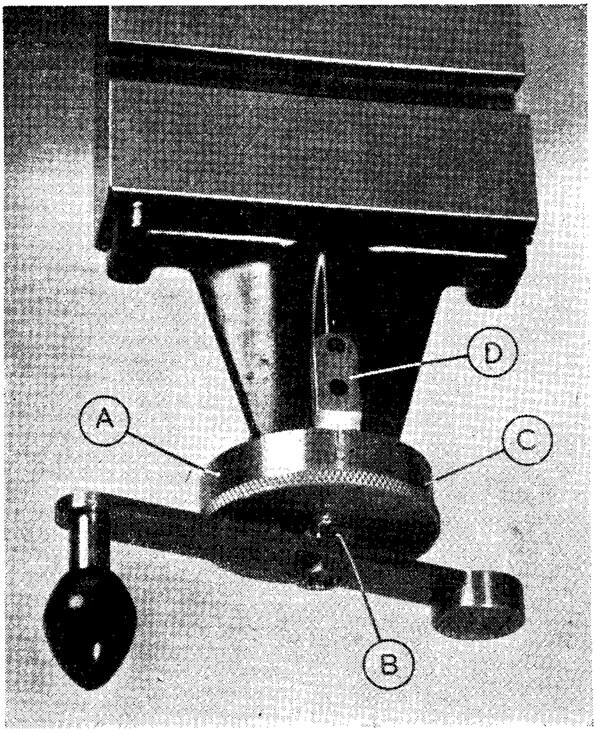


Photo by] [*P. G. Collier*

Fig. 1. *The cross-slide index*

The machining operations involved are quite straightforward and can all be carried out in the lathe itself; moreover, the fitting of this useful addition to the lathe will be found an interesting piece of work, and one which will amply repay the trouble taken.

With regard to the materials used for the index itself, mild-steel will be found quite satisfactory, but brass or bronze may be preferred, as the machining is easier and the appearance, perhaps, rather better; moreover, brass of the diameter required is more readily obtainable.

Construction

The photograph, Fig. 1, shows the general appearance of the index when fitted in place, and the working drawings in Fig. 2 give the details and dimensions of the several parts. It will be seen that the body of the index (*A*) is made to rotate on an inner sleeve (*B*) which screws on to the end of the feed shaft and is secured in place, after adjustment, by means of the feed handle and its lock-nut. It should be noted that this sleeve takes the thrust against the keep-plate bracket when the feedscrew is turned to move the cross-slide inwards.

The sleeve is provided with two spanner flats at its outer end to enable adjustments to be made. The index has a knurled flange to afford a finger grip, and a threaded seating is formed in the plain portion to accommodate the spring-loaded plunger (*C*) which locates the index on the sleeve and, at the same time, provides

*Continued from page 348, "M.E.," March 24, 1949.

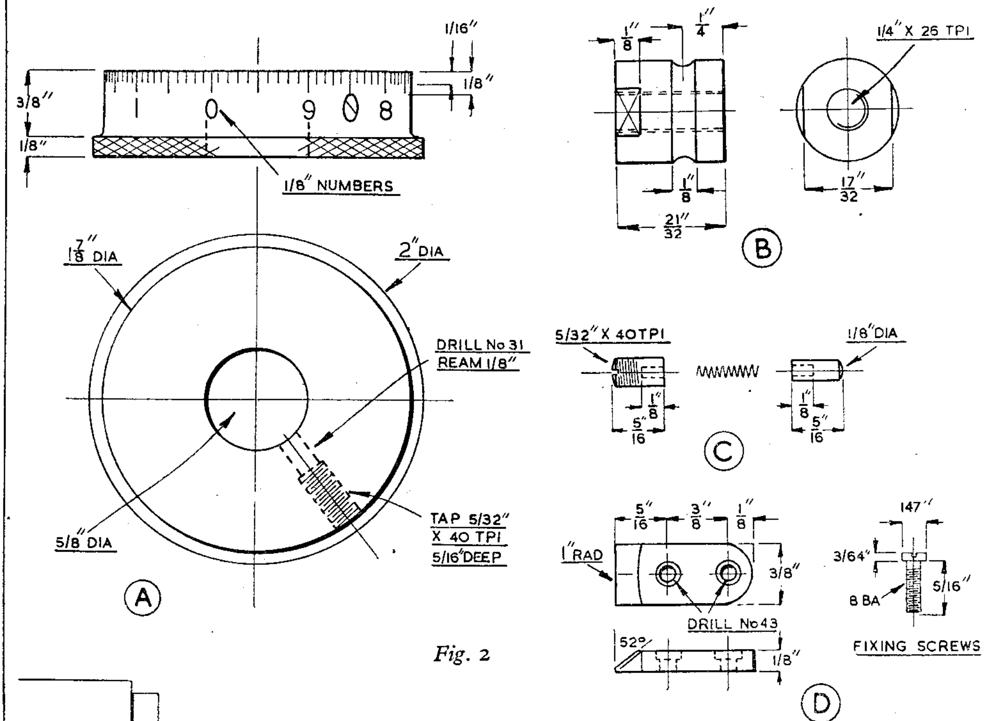


Fig. 2

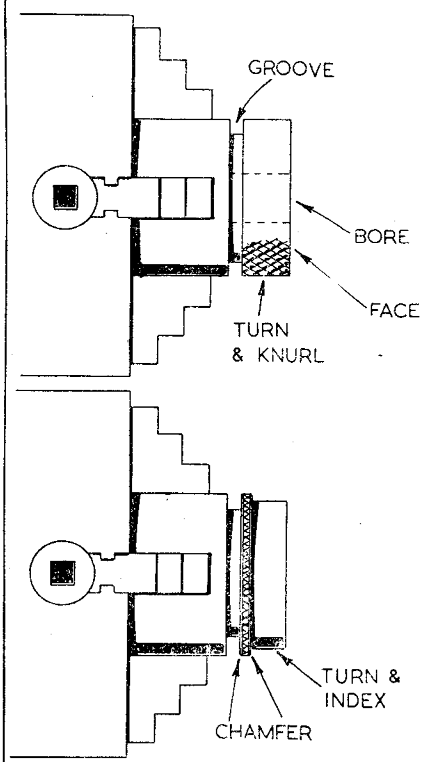


Fig. 3

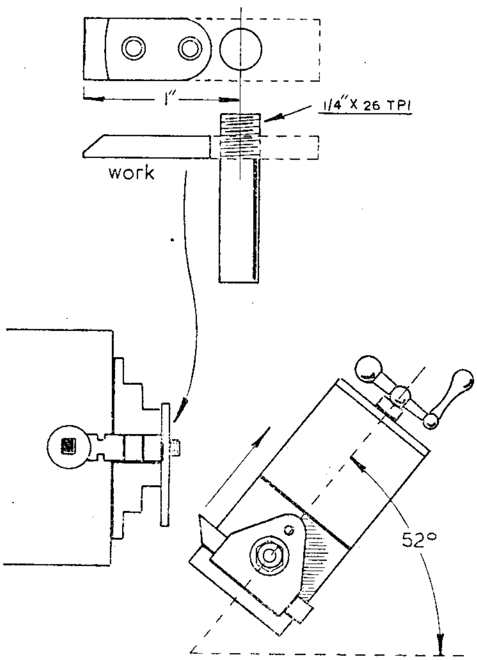


Fig. 4

frictional control, or a positive lock when needed.

The plate (*D*), carrying an index line, is secured by means of two screws to a seating machined on the keep-plate bracket.

Machining the Index

As depicted in Fig. 3, the piece of material selected, which should be of some 2 in. in diameter, is gripped in the self-centring or four-jaw chuck and its end is faced and then drilled and bored to a diameter of $\frac{5}{8}$ in., less 2 thousandths of an inch to allow for reaming to size at a later stage. The outside diameter is next turned to size, and a groove is formed with the parting tool at a distance of slightly more than $\frac{5}{8}$ in. from the end to facilitate the knurling operation which then follows. The portion on which the graduations are to be cut is turned to a diameter $\frac{1}{8}$ in. less than that of the knurled part. The two edges of the knurled flange are then chamfered with a V-pointed tool.

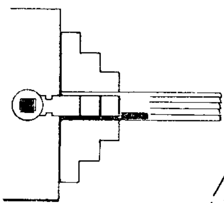
The next operation is to cut the graduations, and for this purpose, a V-tool, having its point formed to an included angle of some 45 deg., is mounted on its side at centre height in the top slide tool holder. To index the work into 100 equal parts, so as to form graduations equal to 1/1,000 in. in conjunction with the 1/10 in. pitch feedscrew, the arrangement of change-wheels and a detent, illustrated in the preceding article is employed; that is to say, a 50-tooth wheel, connected with the mandrel, is geared to a 20-tooth wheel which is attached on the same stud to a 40-tooth wheel so that the latter can be engaged by the detent. In addition, the backlash in the gears must be taken up by using a cord and weight applied to the chuck as previously described.

For the engraving operation, the leadscrew index is set at zero and the V-tool is brought into contact with the flat face of the work by means of the top slide. A cut 2 thousandths of an inch deep is put on with the cross-slide, and the tool is traversed along the work with the leadscrew feed for a distance of $\frac{1}{16}$ in. for the short lines, and for $\frac{1}{8}$ in. to cut the longer lines spaced at 5 thousandth intervals. Each line is formed by taking successive cuts of 2, 1 and 1 thousandth of an inch deep in order not to risk breaking the tip of the tool; it is also advisable to withdraw the tool from the work at the end of each traverse to save wearing the cutting edges and reducing their clearance.

At this stage, the work is removed from the chuck, but before doing so, make a mark with a a centre punch opposite No. 1 jaw so that when the part is again gripped in the chuck it will run truly. Grip the work in the bench vice, using card packings and a supporting block of wood to ensure that no damage is caused when the numerals are hand-struck by means of a hammer and punch.

The punching of the numbers should be carried out in a methodical manner, for any errors made at the time will remain as a lasting eyesore. The work should be positioned so that the engraved lines are towards the operator and the numbers will then, of course, be seen upside-down. Mark in the numbers at every alternate long line with the grease pencil, for it is easy to make the mistake of stamping the numbers upside-down, or to make them running in the reverse direction. Take the No. 1 punch and make a trial impression on a piece of card to make sure that it is the right way up, and also to see if the impression is correctly aligned, for if not, allowance must be made for this when the punch is applied to the work.

Set the punch on the work so that the near edge of the figure is just clear of the end of the engraved line; hold the punch firmly and then strike it a succession of light hammer blows,



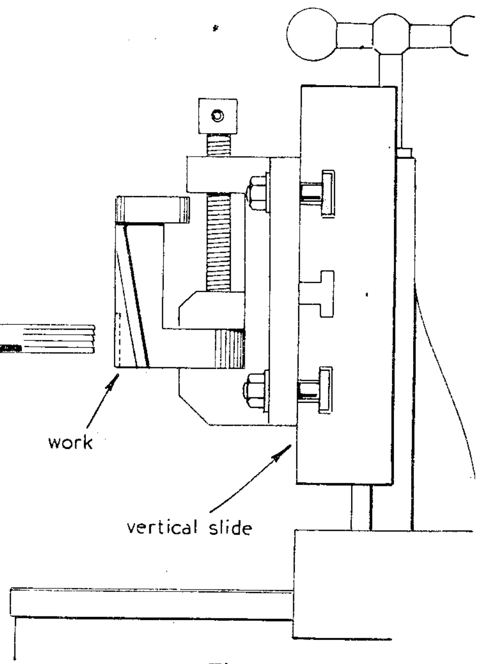


Fig. 5

meanwhile tilting the shank from side to side to conform with the convexity of the work surface. The resulting impression should then be carefully inspected, and if it is weak in any part the punch is reapplied and tilted while being struck, to make good the deficiency. Those who doubt their skill should first practise on a piece of scrap material until proficiency is gained.

The work is next gripped in the chuck and the lines and figures are cleaned up with the aid of a jeweller's file while the lathe is run at high speed; should it be found necessary, the file may be followed by a strip of fine emery cloth backed by a file, bearing in mind that a smooth but not highly polished finish gives the best appearance. The index is then parted off a little longer than its finished length and, when protected by a strip of thin card, it is again secured in the chuck to allow the back of the work to be faced flat and to the correct length.

The hole to receive the plunger and locking-screw is drilled with a No. 31 drill at a point

opposite the 85 mark line; this is to bring the screw into a convenient position for tightening with the right hand when the index is set at zero.

This hole is then tapped 5/32 in. × 40 t.p.i. for a depth of $\frac{5}{16}$ in., and an $\frac{1}{8}$-in. reamer is used to size the hole to accommodate the spring-loaded plunger.

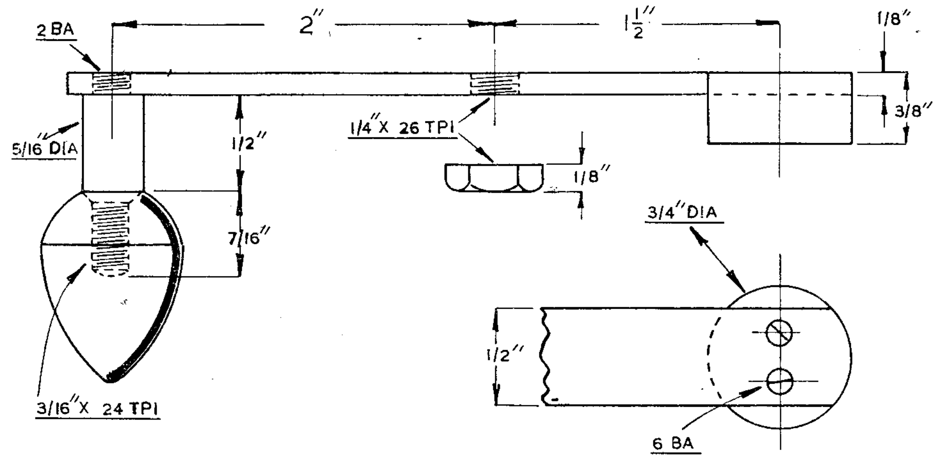


Fig. 6

Finally, a $\frac{5}{8}$ in. diameter reamer is put through the central bore to enlarge it to the finished size and, at the same time, to remove any burrs resulting from the radial drilling operation.

The Index Sleeve

This component is machined from a length of $\frac{3}{4}$ in. diameter mild-steel rod and its dimensions are given in Fig. 2(B). After the end of the work has been faced and centre-drilled in the lathe, a No. 4 drill is entered from the tailstock to a depth of $\frac{7}{8}$ in. and this hole is tapped $\frac{1}{4}$ in. × 26 t.p.i. while the part is still held in the chuck; the sleeve is then parted off slightly in excess of its finished length. As it is essential that the index when mounted on its sleeve should rotate truly with the feedscrew, it is advisable to machine the sleeve to its finished diameter whilst threaded on its own shaft.

For this purpose, the cross-slide feedscrew is removed and then gripped to run truly in the four-jaw chuck; the sleeve is next screwed on to the projecting end of the shaft, and a centre drill is used to form a centre hole so that the feedscrew can be supported by the tailstock centre during the subsequent machining operations.

As the cross-slide has been deprived of its feedscrew, it is securely locked by tightening the gib adjusting-screws, and the top slide is set over and then used to provide the cross-feed for the tool.

The external diameter of the sleeve is turned to a firm push fit in the bore of the index, and the groove to receive the point of the plunger is cut with a round-nosed tool; this is followed by finishing these machined surfaces with a strip of fine abrasive cloth to ensure smooth working of the assembled parts.

The sleeve is then removed from its shaft and mounted in the chuck so that the back face can be machined to reduce the part to its finished length.

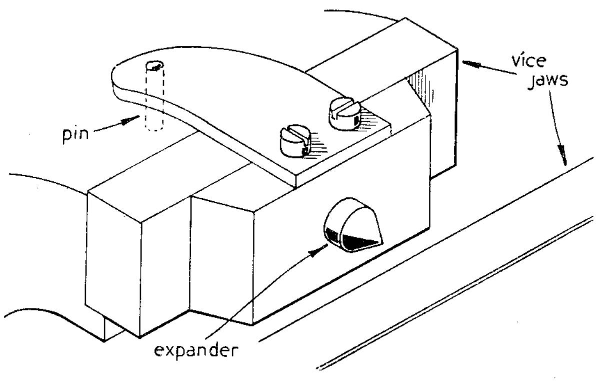


Fig. 7

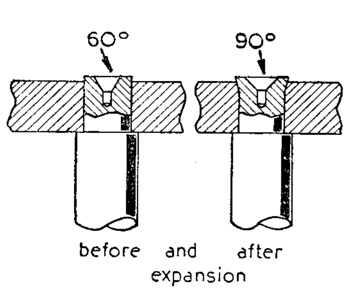


Fig. 8

The next step is to form the two flats on the end of the sleeve to take a thin $\frac{1}{4}$ in. Whitworth nut-size spanner.

This operation can readily be carried out by milling or with the aid of a filing rest, using a change-wheel secured to the mandrel to index the two opposite machining positions; but if neither of these attachments is available, the sleeve should be gripped in the vice to lie horizontally, and a washer is slipped over its end to act as a stop and to protect the vice jaws while the flats are formed by hand filing. The first flat is filed to a depth of 3/64 in. as checked with

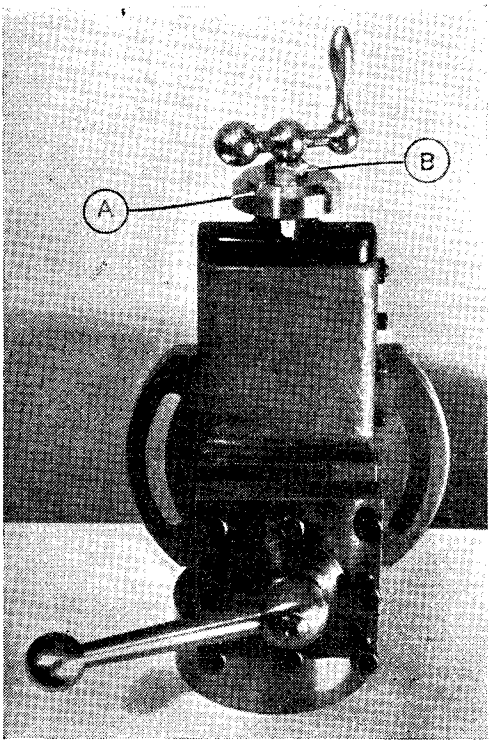


Photo by] [*P. G. Collier*

Fig. 9. The top-slide index

the micrometer; the opposing flat is then filed to make the distance across the flats 17/32 in., and the micrometer is again used both to check this dimension and to make sure that the flats are parallel.

The Spring-loaded Plunger

To complete the construction of the index, the spring-loaded brass plunger and its mild-steel adjusting screw have to be fitted to the seating already tapped and reamed in the index body. The constructional details and dimensions of these two parts are shown in Fig. 2 (C).

As the overall diameter of the index at this point is shown as $1\frac{7}{8}$ in., the radial distance from the periphery to the bore is $\frac{5}{8}$ in.; this allows the two component parts of the plunger to be separated by a distance of some 1/32 in. when the point of the plunger is engaged in the groove formed in the sleeve, and the head of the adjusting screw then lies flush with the surface. If the screw is further tightened, the plunger is forced inwards and the index then becomes locked to the sleeve.

The parts are machined in accordance with the working drawings, but it should be noted that the brass plunger is made a good sliding fit in its reamed hole. The spring can conveniently be made from a length of small diameter stiff spring of the sort used in some makes of petrol lighters.

The Fixed Index Plate

To enable the setting of the index to be easily and correctly read, a plate engraved with an index line is attached to the keep-plate bracket, as may be seen in Fig. 1.

As this small fitting occupies a conspicuous place on the lathe and is being constantly referred to, it is as well that it should be carefully made and the index line accurately machine cut.

The dimensions are shown in Fig. 2 (D), and one method of machining the part is illustrated in Fig. 4.

The plate is made from a length of mild-steel $\frac{3}{8}$ in. wide, $\frac{1}{8}$ in. thick, and about $1\frac{1}{2}$ in. long.

To machine the curved surface bearing the index line to match the curvature of the circular index, the material is drilled and tapped so that it can be attached to a $\frac{1}{4}$ in. diameter rod gripped in the lathe chuck. The top slide is set over to 52 deg. and the end of the plate is machined as represented in the drawing. The finished surface is then painted with marking fluid and its centre-line is scribed with the jenny callipers.

When the lathe mandrel has been locked, a V-pointed tool clamped on its side, is secured in the tool holder, and the chuck jaws are slackened to allow the work to be rotated in order to bring the scribed centre-line level with the point of the tool.

The index line is cut to the same breadth as the lines on the circular index by feeding the tool in to a depth of rather more than 4 thousandths of an inch, and the length of the line is determined by traversing the top slide inwards towards the centre.

Finally, a very light cut is taken over the work to remove any burrs from the engraved surface. The clearing holes for the fixing screws are next marked-out and drilled, and at the same time the recesses for the screw heads are counter-drilled.

The next step is to machine the seating for the index plate on the keep-plate bracket. This can be readily done by gripping the bracket in a machine vice attached to the vertical slide, as shown in Fig. 5, and an end-mill or fly-cutter is then employed to form the seating with a curved surface at its upper end.

The index plate should now be filed to fit into this seating so that the end bearing the index line clears the circular index by a few thousandths of an inch only, whilst the opposed curved surfaces should mate correctly. It now only remains to drill and tap the holes for the screws securing the index plate in place, and when doing this it is advisable to insert one screw

and then to align the plate by means of a square resting on the machined surface at the back of the bracket; the second screw can then be fitted with the parts in place.

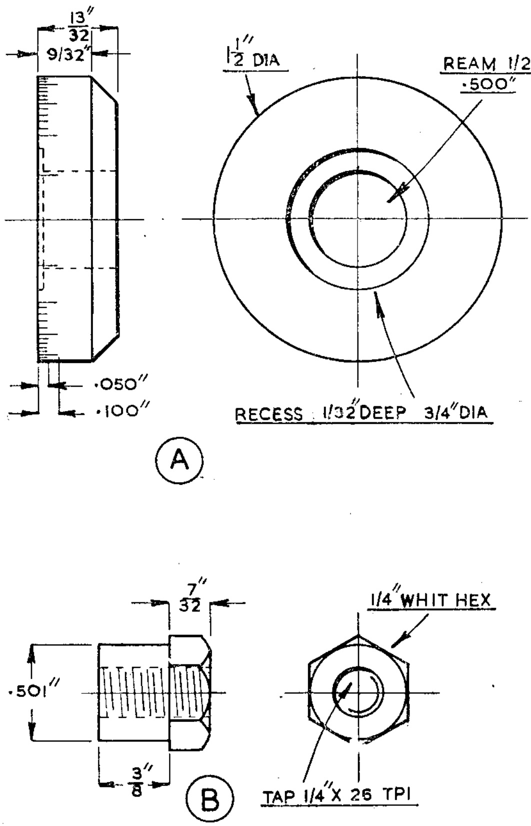


Fig. 10

The balance weight is cut from a piece of ¾-in. diameter round mild-steel, and its length, and so its weight, will depend in part on the weight of the handle fitted at the other end.

The weight is slotted to fit over the bar and is retained in place by one or more 6-B.A. countersunk screws inserted from behind.

The finger grip, made of ebonite or plastic material, is attached by means of a double-ended stud, as shown in the drawing, and to secure the stud in the bar, its end should be expanded after it has been screwed in place. This method of fixing is neat in appearance and saves fitting an unsightly lock-nut.

When a stud is fitted in this way, its end is drilled with a centre drill and the recess so formed can be expanded by means of a handpunch or by forcing a cycle ball in the vice; but a more satisfactory method is to use a tool of the form illustrated in Fig. 7. This device is supported on the vice jaw by means of the strap and pin illustrated, thus leaving the hands free to hold the work and tighten the vice.

When constructing the tool, silver-steel should be used for making the expander punch which has its point machined to an included angle of 90 deg. and afterwards polished; this part should be hardened and then tempered to a straw colour.

When, as shown in Fig. 8, the expander is forced by the vice jaws into the conical recess formed by the centre drill, the end of the stud is expanded and at the same time pressed into the surrounding metal. To obtain a good appearance in the finished assembly, the stud before expansion should project for a few thousandths of an inch beyond only the surface of the work.

It is not, of course, essential to screw thread the components, and a secure fixing will be obtained if they are left plain, as is usually the case in manufactured articles.

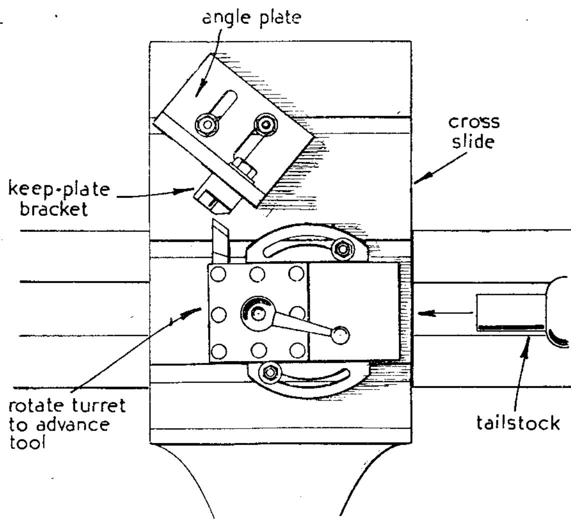


Fig. 11

A Long Handle for the Cross-slide Feed

Where the saddle is not equipped with an automatic surfacing feed, some workers find it easier to manipulate the cross-slide feed with a handle that gives greater leverage than the short form of handle generally fitted to small lathes, for this attachment enables a continuous regular turning motion to be maintained with but little hand pressure.

The type of cross-slide feed handle shown in Fig. 1 certainly facilitates the work when long facing cuts have to be taken. As shown in Fig. 6 the bar of the handle is made from a length of ½ in. × ⅛ in. mild-steel, drilled and threaded ¼ in. × 26 t.p.i. for attachment to the feed-screw.

Studs fitted in this way can be readily removed by drilling into the recess formed by the centre drill until the expanded portion is thinned or cut away.

When fitting the handle to the feedscrew, the sleeve carrying the index is adjusted to take up the backlash, and the handle is then screwed up hard against the end of the sleeve and secured against unscrewing by tightening the lock-nut.

A Top Slide Index

The index described, when fitted to the cross-slide, may seem a little out of keeping with the standard top slide index. If this is found to be the case, a new index for the top slide can easily be made, but in this instance a fixed type of index is on the whole to be preferred.

The general design of an index of this type is illustrated in Fig. 9. Here, the index itself acts as a thrust collar, and it is locked on the threaded portion of the feedscrew by means of the operating handle.

Reference to the working drawings in Fig. 10 will show that the body (*A*) of the index is made a press fit on the internally threaded sleeve (*B*); but those who so prefer, can make these parts a working fit, and by adding a spring plunger, as in the previous example, an adjustable type of index will result.

The index body is first machined and graduated in exactly the same manner as the cross-slide index; but, in addition, a recess ¾ in. in diameter and 1/32 in. deep is turned in the back face of the body to accommodate the standard thrust washer, and the bore is finally reamed to exactly ½ in. in diameter.

The sleeve (*B*) is best made from a length of ½-in. Whitworth nut-size hexagon steel rod. To ensure that the external diameter is concentric with the threaded bore, the sleeve should be turned while mounted on its feedscrew, as in the previous example; during this operation the top slide is locked by tightening its gib adjusting screws.

As will be seen, this part is turned to an overall diameter of 0.501 in. to afford an interference fit, and when it has been pressed into place in the vice, the whole assembly should revolve quite truly when mounted on the feedscrew.

The next step is to cut the fixed index line on the keep-plate bracket, and, here again, to ensure a satisfactory result, this line is engraved by a machining operation.

Although there are, of course, many ways of doing this, a simple method, illustrated in Fig. 11, is to mount the bracket on an angle-plate attached to the cross-slide and set so that the inclined face bearing the index line lies approximately parallel with the lathe axis.

A square-ended tool, clamped on its slide in the tool holder, is first used to cut a small flat face on the work to carry the index line. As its keep-plate has been removed, the top slide is actuated by feeding the tailstock barrel against the tool turret. The tool is fed into cut by slightly rotating the turret in order to bring the point of the tool nearer to the work. When a well-finished surface has been machined in this way, a V-pointed tool is clamped on its side in the tool holder and the index line is cut in a similar manner.

(*To be continued*)

For the Bookshelf

Spritsail Barges of the Thames and Medway. By Edgar J. March. (London: Percival Marshall & Co. Ltd.) Price 30s. net.

This book which is the largest and most important book so far published by our Book Department is having a strong appeal for many of our readers. Judging by the frequency with which we see models of Spritsail Barges at THE MODEL ENGINEER Exhibition, there is a considerable interest in this type of craft. They are the last commercial sailing craft to survive in our coastal waters and as such are well worthy of being recorded in model form, especially as it is still possible to see the prototype and to secure authentic details. The book gives a complete history of the development of the type, also of the Thames Barge Races from 1865 until they were discontinued owing to the war, and concludes with detailed information as to the hull and rigging, which is exactly what the model-maker needs. The illustrations include scale drawings and detail sketches of the spritsail barge in its various forms done in the style which was so much appreciated in the articles Mr. March wrote for THE MODEL ENGINEER some years ago. There are also a great number of magnificent photographs of barges under sail, and in fact under all conditions. This is a book which will be treasured by the shipmodeller and by the ship-lover alike.

The Bishop's Castle Railway, by E. C. Griffith, B.A. (Farnham, Surrey: 23, Downing Street.) 54 pages, size 5½ in. by 8½ in. Price 5s. 6d.

Of all the British light railways, the Bishop's Castle Railway was, in many respects, the most interesting as well as the most unfortunate. Throughout nearly the whole of its existence, it was in the hands of a Receiver, and struggled hard against financial stringency. In this respect it was probably unique; yet it served a useful purpose in the extremely remote district in which it operated.

The story is a very long one which is faithfully set down in this book; the illustrations are excellent, most of them absolutely typical, while a few must rank among the most extraordinary railway photographs ever taken. But the Bishop's Castle Railway was like that! Its appeal to many railway enthusiasts was terrific; its story arouses nostalgic memories, and the reader may well wonder whether the little line received the treatment it really deserved.

A Passenger-Hauling Clockwork Loco

by C. Baker

THIS is the story of a toy, a clockwork locomotive built primarily for the amusement of a child. It shows what can be done with old junk, a drop of originality and an ocean of improvisation, although the work is no example of good engineering practice.

The Specification

The need was for a foolproof engine of simple yet robust design, reasonably realistic in appearance and powerful enough to haul a child over part of a $2\frac{1}{2}$-in. gauge garden railway. All these requirements are met by the model illustrated. Before embarking on the job, the form of motive-power had to be settled and, after ruling out steam on account of its obvious disadvantages, the electric motor was considered and, in turn, rejected for want of a suitable power supply and the provision of conductor rails on the layout. Attention was then focused on an old gramophone which lay amongst the workshop junk, and investigation proved it to contain the ideal power-plant.

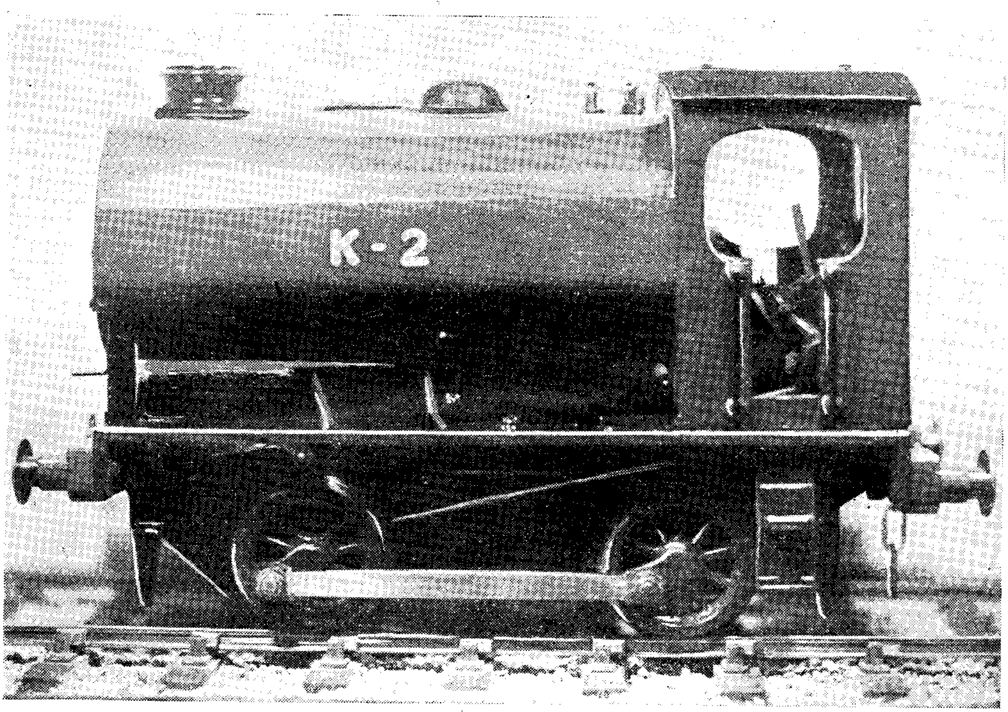
The Gramophone Mechanism

Now clockwork can never be as popular for model train propulsion as heat engines or electricity, both of which develop their mechanical energy from an extraneous source of a different kind, whereas the strain energy of a spring is stored in it by hard, manual winding and is proportional to the size of the spring and the enthusiasm of the operator! But it is essentially practical and almost foolproof in operation.

The gramophone motor in question is of simple design comprising a very powerful spring contained in a cylindrical housing around the periphery of which is riveted a toothed wheel which drives a worm at a 1-to-30 ratio. The record turntable was carried on the worm spindle at one end whilst, at the other end, a small toothed wheel was mounted ; this meshed with a second worm giving a further 1-to-14 step-up for a Watt-type centrifugal governor which controlled the speed of the record by applying a brake to a friction-disc fitted on the governor-shaft. That comprised the whole of the original mechanism, apart from a massive iron casting by which it was suspended from the top of the cabinet.

Building up the Locomotive Mechanism

The flat mounting surface of the casting formed a natural base, so the mechanism was turned over. It then became apparent that, if the wheels were to be fitted underneath it, the engine would be

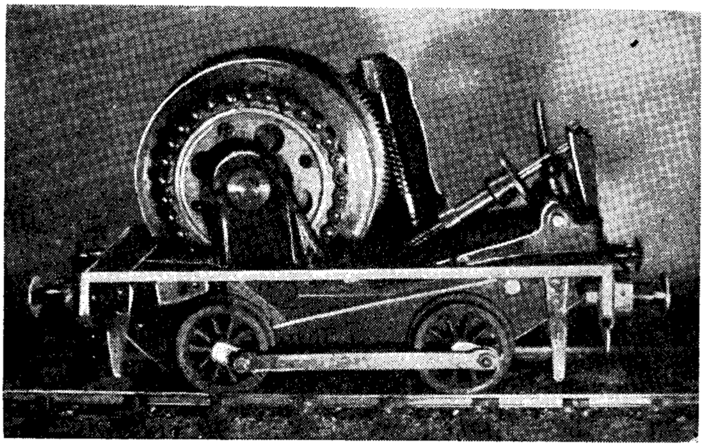


Side view of the finished engine

much too high. To maintain reasonable proportions the casting would have to be carried between the wheels, but it was much too big for that, for only at one end could it be cut down to a dimension which would make it possible. A compromise was sought and it was found that by tilting the base through an angle of 10 deg. to the track, the height could be kept almost to scale, although the trailing wheels would still be fitted below the casting. Then the hacksaw was got to work; a pound or so of surplus iron was removed and the casting trimmed up generally to pass the loading gauge.

The next stage was to decide the gearing to be adopted, the method of transmission and the wheel arrangement of the engine. To connect the drive to the old gramophone record shaft would have been difficult on account of its position and involve gearing down; but there was adequate space at the side of the spring-housing for a sprocket, and so a direct chain-drive from the spring to the axle was employed. A bicycle type of chain was used and two old sprockets were found in the workshop rubbish; they had a ratio of 3 to 1, and this proved about right for 1¾-in. running wheels. The driving sprocket is fitted to the spring-housing with four 4-B.A. screws in holes tapped in the casing, and the driven sprocket is held by a grub-screw to the leading axle. The sprocket centres could not be arranged to suit a given length of chain, since the construction of it necessitated at least two links being removed at a time and a brass jockey-pulley had to be fitted to take up the slack. It is adjustably mounted and makes allowance for the free movement of the spring-housing on its shaft; the original design allowed for a relatively slack fit. Being a toy, reversing gear was considered an unnecessary refinement; the engine must be wound up at the end of each run and can then be turned round. Operating in one direction only was to be the rule and so the slack side of the chain is always the same, and fitting the jockey-pulley presented no difficulties.

To give a high power output for short periods, the motor must run much faster than its original speed and, in the over-speeding condition the centrifugal force would burst the light spring arms of the governor. The revolving ball-weights were, therefore, removed, and the revving of the governor shaft with its centre mass and brake friction plate was found to give sufficient speed control for the engine under load.



The mechanism assembled

The wheels were the next consideration. A six-coupled engine was considered first, then the use of a radial truck; but, for simplicity, the 0-4-0 arrangement was finally adopted. Now 3 ft. 6 in. drivers are rather small; but 1¾-in. diameter wheels were called for, and these were procured. Unfortunately, they had no cranks but a trial showed that, with a simple jig, a hole for a 2-B.A. bolt could be drilled between two adjacent spokes and a simple crank cut from 18-s.w.g. brass and soft-soldered to the spokes from the wheel centre to the crankpin. The axles were made from ¼-in. mild-steel bar and the wheels, drilled to slide over them, were sweated in position. They were also locked with ⅛-in. diameter keys soldered into holes drilled half in the end of the axle and half in the wheel casting. It is an unorthodox method of assembly, but simple and adequate for the job in hand. The wheels were, of course, turned in the usual way to the standard dimensions for 2½-in. gauge rolling stock. The side rods, of ¼-in. × 3/32-in. maximum cross section, were cut from steel which had once seen service as a dust-bin handle!

The size of the wheels determined the shape and style of frames. The side members taper to suit the angle of the main casting and vary from ⅜ in. at the leading axle to 1⅝ in. at the rear; they are cut from 20-s.w.g. mild-steel plate flanged along the upper edge and screwed to the casting. The trailing axleboxes, cut from ½-in. × ¼-in. drawn brass, are riveted directly to the frame; but the leading boxes could not be accommodated in the space available. Specially-shaped bearings had to be machined and these were screwed to the underside of the casting. No springing is provided on either axle.

Considerable use has been made of light alloys; they are easy to work and, since the completed engine weighs over 7 lb. and needs no ballast to give it the necessary adhesion, the aluminium alloys are ideal for this model. Frame stretchers of this material were riveted in position with aluminium rivets; the buffer-beams were cut from extruded light alloy angles and screwed to the casting whilst the running-plate and outer framework were combined in a ⅛-in. thick strip each side of the engine, shaped to fit the casting.

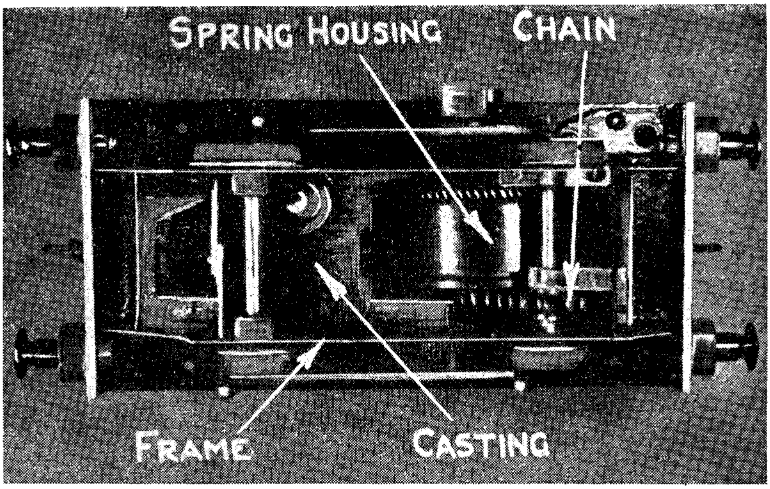
Superstructure

The superstructure follows the outline of docks and contractor's locomotives and consists essentially of a combined boiler and pannier-tank unit and a cab. The former is designed to enclose the mechanism as far as possible. Some of the lower portion is just visible and the top of the main toothed wheel protrudes through the tank profile where it is covered by a dummy manhole. The front and back plates were cut from $\frac{3}{8}$-in. plywood and to these the wrapper of 20-s.w.g. aluminium sheet was screwed. The smokebox door made from the bottom of an old tin embellished with a dart and hinges of light alloy, is secured with woodscrews. The chimney, dome, safety-valves and a whistle could not readily be improvised and the more orthodox method of turning them from bar had to be resorted to! Below the tanks, cover panels were necessary to represent the firebox and help to conceal the mechanism, and these were riveted and screwed in position as required.

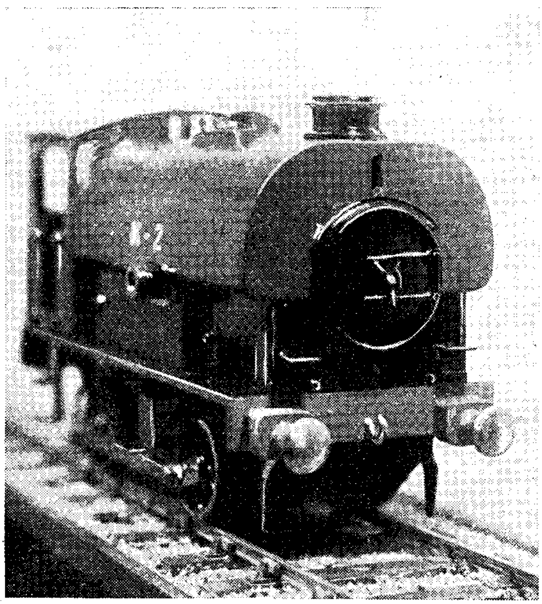
The cab was folded up from two pieces of light alloy plate cut out with a fretsaw, flanged for attachment to the casting and for the roof and than all riveted together. It was fitted directly to the boiler unit with woodscrews driven into the " backplate." The handrails were made of wire soldered to the heads of screws fitted in the cab sides, and the front and rear window apertures were glazed inside, with glass cut from old photographic plates.

The buffers are adapted from some old large-headed screws, mounted on light alloy pads and bolted to the beams, whilst the wheel guards and steps and the front and rear lamp brackets, which complete the external details, were cut from 20-s.w.g. mild steel and assembled with the aid of aluminium rivets.

The engine will exert a drawbar pull, measured with a spring-balance, of 4 lb. when starting and it can only be arrested at speed by a force of over 6 lb., after which the wheels continue to slip until it is completely wound down. Its maximum run, which varies little with load, is approximately 30 ft., and this is accomplished in about 25 sec. The engine is easily wound at a key point just below the tank and started by releasing a brake lever conveniently situated in the cab. The model works well and, although open to criticism, can be regarded as having fulfilled its purpose.



The underside


Three-quarter front view

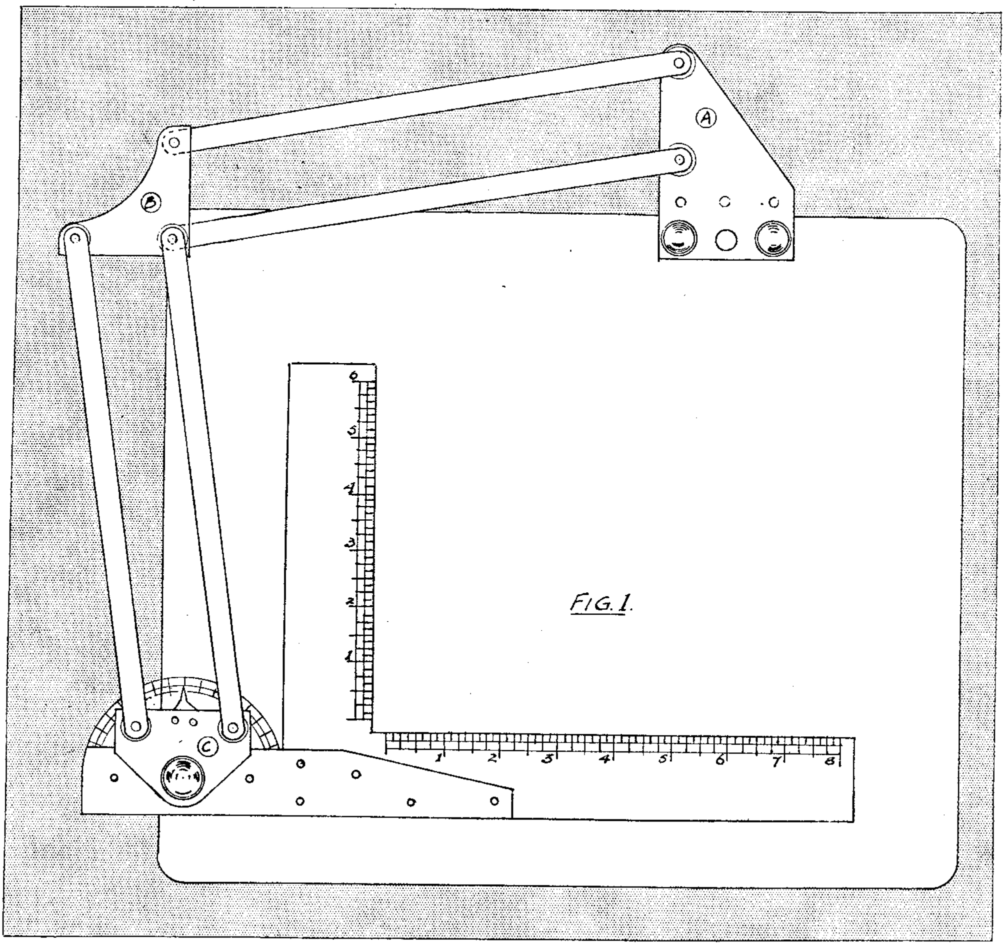
It may be remarked that it is too tall, too stumpy, has too small a set of wheels, that it should have outside cylinders and that the trailing axle passes through the firebox! The writer is not only aware of its shortcomings but fully conscious of the imperative need for accuracy and realism in serious model railways. This, however, is but a toy, and the art of making anything and achieving its purpose lies in the adoption of methods and designs most suited to the particular work in hand.

A Simple Draughting Machine

by T. J. Lewis

THE main considerations governing the design of this machine were—(i) it would be suitable for use by High School pupils taking a course of practical geometry and engineering drawing, (ii) it could be constructed by these pupils as a metalwork project involving simple bench and machine work, (iii) it could be made of materials readily available, and (iv) the degree of accuracy essential in such an instrument could be attained by simple precautions.

Twelve of these machines have been constructed and used regularly during the past year. They have proved serviceable and accurate. Mechanical aids for students may be frowned upon by some critics, but it must be remembered that tee-squares and set-squares can also be regarded as such. The machine is made and used by upper-form pupils after much practice with tee-squares and set-squares, and when its advantages can be appreciated.



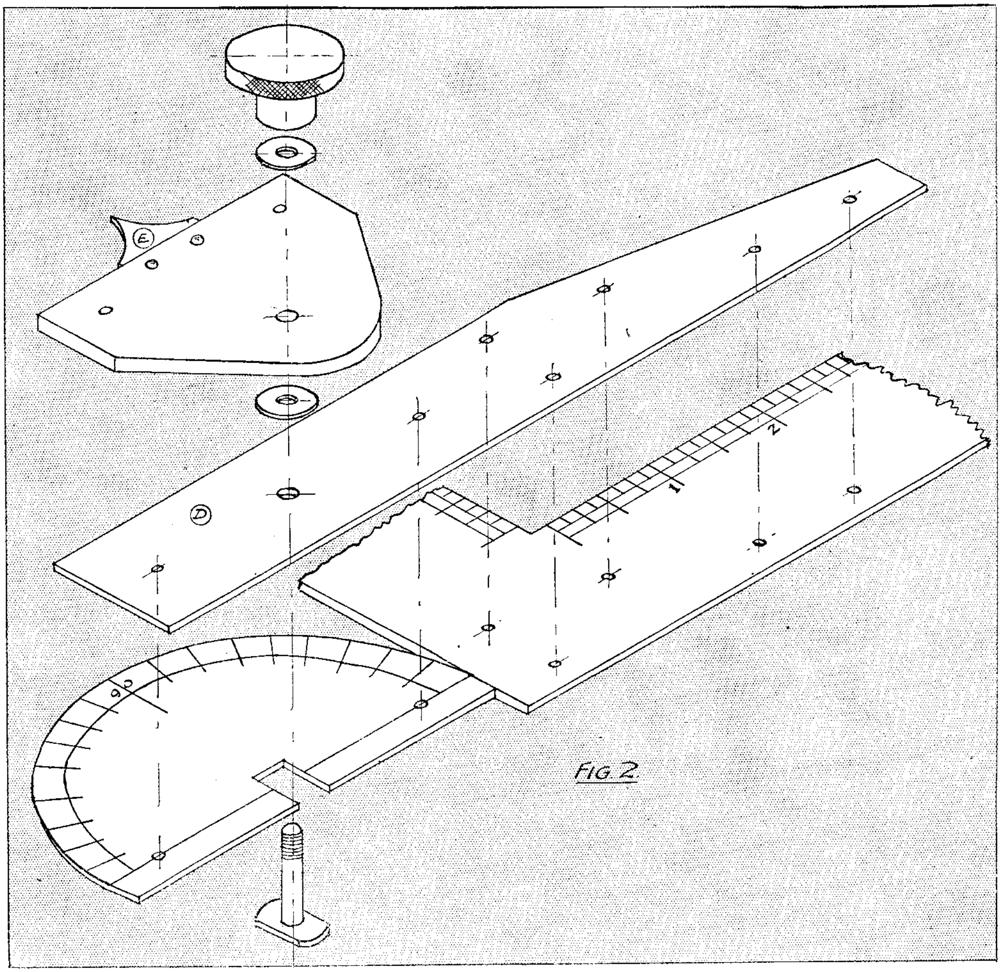
General arrangement of the draughting machine attached to a drawing board

Constructional Details

The sizes given in the drawings, as read from the scale, will be found suitable for half-imperial drawing boards. The general arrangement is shown in Fig. 1, with details of construction in the "exploded" isometric drawings Figs. 2 and 3, dealing with the scale-head and clamping

bracket assemblies respectively. The bracket plate *A*, the crosshead plate *B* and the scale-head plate *C*, as shown in Fig. 1, are made of 10-gauge brass or aluminium according to which of these materials is available. The spacing of each matching pair of pivot holes to be drilled shorter than the other. It makes little difference where the shorter pair is arranged in the assembling.

The pivots are made of $\frac{1}{8}$-in. diameter bright drawn mild-steel rod and the holes are drilled to suit. A tight fit is unnecessary and it would



An exploded isometric drawing of the scale-head assembly for the draughting machine

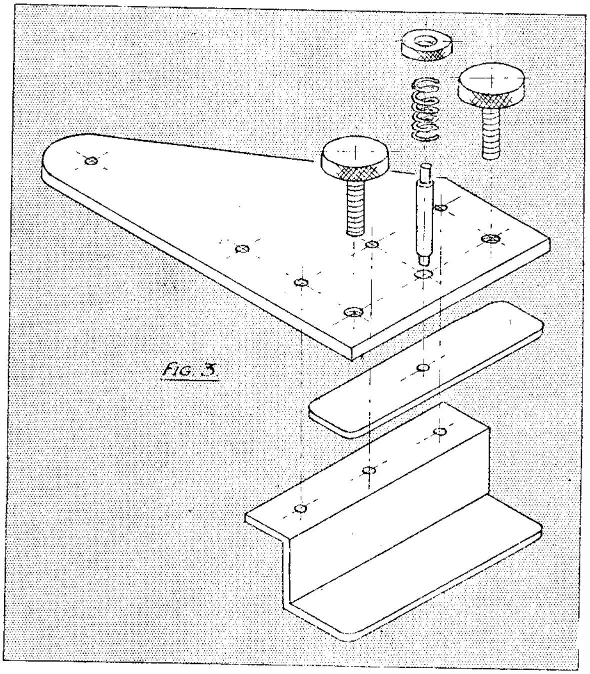
in these plates for hingeing the parallel rods must be accurate, but this is easily done by clamping the corresponding parts together for the drilling operation.

The parallel rods are made of brass curtain rod sold by the popular stores at 6d. per foot. This is approximately $\frac{3}{8}$ in. wide and 14 gauge thickness. A 4-ft. length is needed for this machine. Here again, when drilling for pivots, each pair of rods must be securely clamped together. The accuracy of this drilling largely governs the accuracy of the machine, and to avoid confusion one pair of rods is made $\frac{1}{2}$ in.

cause the scale to " spring " off the required position on the drawing paper ; nevertheless, a good fit is required. The pivots are cut to allow 1/32 in. projecting and the ends are given a few taps with the *face* of the hammer, this being sufficient to keep them in position. Heavy riveting would be unsightly and result in stiffness. A brass washer is used between the rod and the plate at each pivot joint to reduce rubbing action. A spot of oil was put on each joint during assembly and after a year's use no wear is noticeable at any point.

Referring to Fig. 2, which shows the assembly

of the scale-head, minus the parallel rods, it will be seen that the scale proper and the protractor are riveted to a strip of 16-gauge brass or aluminium, marked *D*. The scale is made of celluloid sheet about $\frac{1}{16}$ in. thick which is easily cut to shape with a pair of sharp tinsnips The edges are finished with smooth files and glasspaper. The first batch of scales was divided into inches and eighths by clamping each one on the table of a horizontal milling machine and marking the divisions with a sharp pointed tool clamped between two washers on the arbor. The spacing was done by reading off the index collar on the cross-slide screw. This method was certainly accurate but took up too much time. Later it was found that quite a serviceable scale could be produced by clamping a steel rule under the scale and marking the required divisions, as seen through the scale, by means of a scriber and a small engineer's square. The lines parallel to the edges are marked with jenny callipers.



An exploded isometric drawing of the clamping bracket assembly for the draughting machine

Positioning the Protractor

The protractor is the usual celluloid type of $3\frac{1}{2}$ in. diameter. It pays to obtain one having deeply marked divisions otherwise they are soon obliterated by rubbing on the drawing paper. Its accurate positioning on strip *D* is done by first drilling a $\frac{3}{16}$-in. hole in the centre of the protractor and on the centre-line of the strip $1\frac{3}{4}$ in. from the left-hand end. Both strip and protractor are lined up on their centre-lines with a short length of $\frac{3}{16}$-in. rod passing through the holes and are clamped together while the rivet holes are drilled through both. A rectangular slot is then filed in the protractor to take the " flatted " head of the scale-head clamping screw which is made of brass and screwed 2-B.A. It should be noted that filing the slot in the protractor removes the hole used for positioning. The rivets used are 3/32-in. countersink head, copper or aluminium. The countersinks are made on the underside of the scale and protractor, the heads of the rivets being reduced to give a flush fitting. A small pointer of 16-gauge metal is riveted to the scale-head plate to read off the protractor. The " point " is left about $\frac{1}{8}$ in. wide and is finished off to line up on 90 deg. when the bracket *A* is clamped hard against the upper edge of the drawing board and the scale is set parallel to the corresponding edges of the board.

The Bracket Assembly

The bracket assembly shown in Fig. 3, again minus the parallel rods, calls for a brief description. The clamping arrangement requires a piece of 16-gauge metal having a double bend as shown, and which is riveted to the plate using three $\frac{1}{8}$-in. rivets. The clamping screws are 2-B.A. and their points bear against a pad, again of 16-gauge metal, which is provided with a simple retracting arrangement. A short length of $\frac{3}{16}$ in. diameter brass rod is reduced to $\frac{1}{8}$ in. diameter at both ends; the pad piece is riveted to the lower end and then the rod is passed through the hole in plate to receive the spring and brass washer, the latter being riveted on. This arrangement lifts the pad when the clamping screws are released allowing the drawing paper to be slipped underneath. No drawing pins are required and the drawing board and paper are unmarked.

The crosshead *B* calls for little comment. Its weight is reduced by shaping as shown and it will be noted that one of the pivots serves two parallel rods and will have to be made longer to suit.

Compared with the usual method of drawing with tee-square and set-squares the advantages of even such a simple draughting machine as that described here are bound to be recognised. Its cost is a matter of shillings and can be kept very low by using any material available. It is convenient—the drawing board can be rested in one's lap, and most drawing can be executed by the use of a compass and a pencil only in addition to the machine.

At the time of writing, a further batch of these machines is being constructed by a group of nine pupils.

A final note—although turned and knurled parts give a good finish to the machine, one can improvise with standard screws and wing-nuts, making a lathe unnecessary.

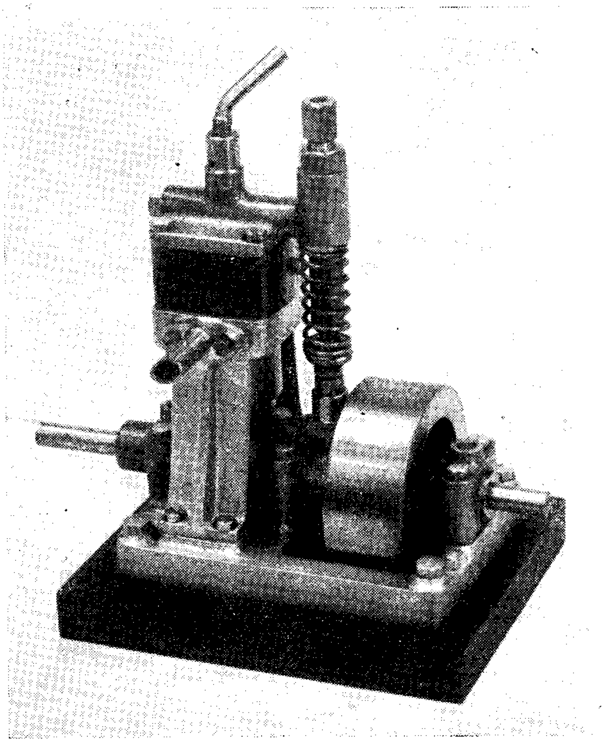
*UTILITY STEAM ENGINES

by Edgar T. Westbury

THE normal type of steam engine is probably the most adaptable of all engines to working under varying conditions ; it will produce a high torque at low speed, or a low torque at high speed, the actual power produced being practically the same in either case. Some slight modification of valve setting may be called for to produce the best results at either extreme—high speed, for instance, usually calls for increase of lead—and if a direct-driven feed pump is used, the displacement of the latter or the ratio of its gearing may have to be adjusted ; but there is little else about the engine which calls for alteration. This applies to the range of speeds up to about 1,000 or 2,000 r.p.m., and while it is quite possible to run engines of normal type much faster than this, it is not generally discreet to do so, for various practical reasons.

First, the weight of the reciprocating parts in the orthodox form of steam engine is greater than is desirable, and cannot be reduced to any considerable extent without dangerously lowering margins of strength. Secondly, there are more working parts than are desirable, and some of them are not too easy to keep properly lubricated. And thirdly, the packing glands of the double-acting engine are liable to produce excessive friction and give trouble when subjected continuously to the combined effects of high pressure and high piston-rod speed.

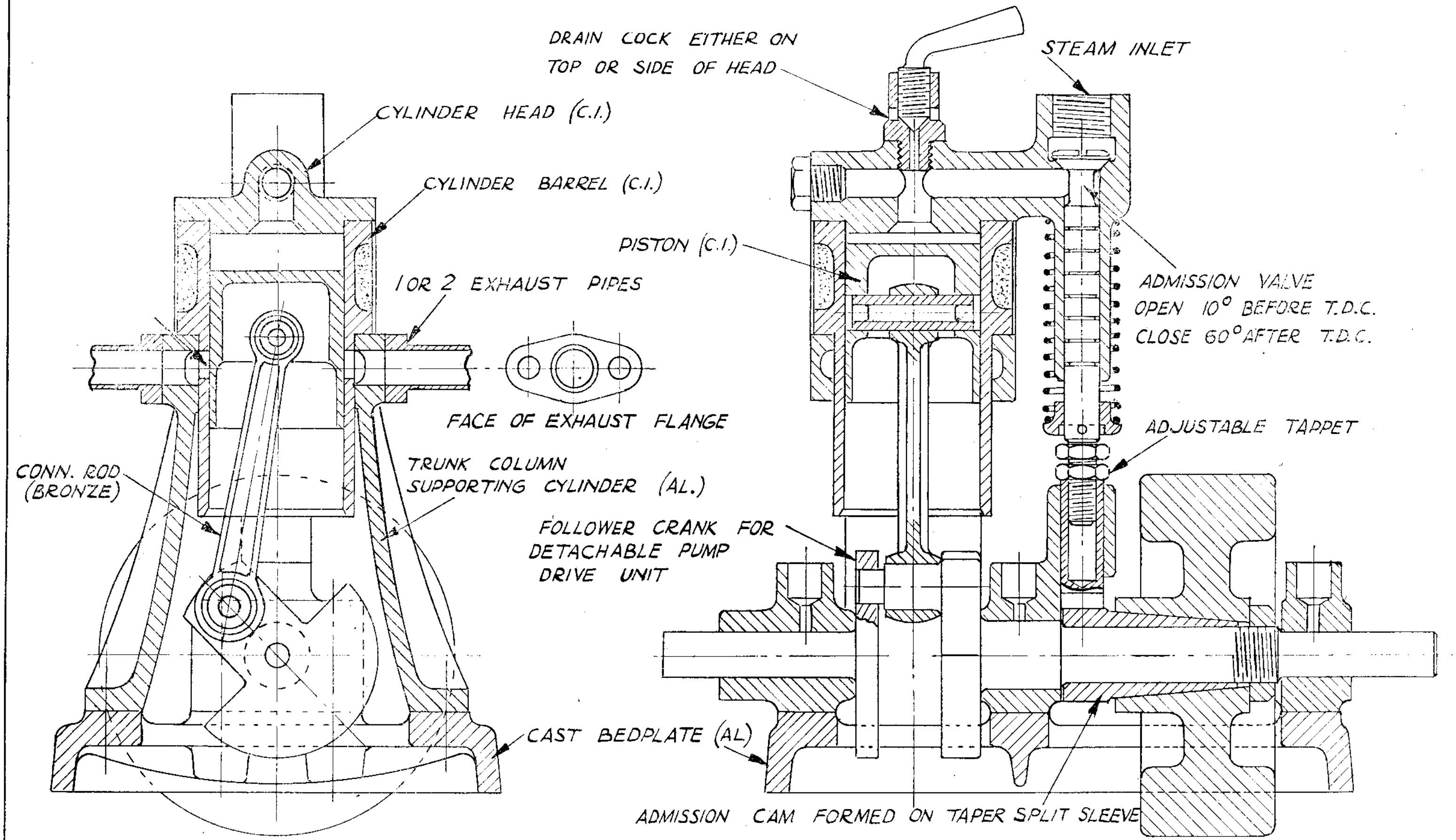
It is, therefore, quite logical to adopt a form of engine having a simpler mechanical system, lighter reciprocating parts, and an absence of packing glands, when it is intended to run habitually at speeds well in excess of 1,000 r.p.m. This very often calls for some sacrifice of flexibility, and such an engine may be neither so handsome in appearance nor so pleasant to run as the more orthodox type, but its existence is justified on the grounds of utility. Many designs for such engines have been published in the "M.E." at various times, and though they vary widely in details, they are nearly all of the single-acting type, with trunk pistons, and by far the majority are fitted with slide or piston valves operated by eccentrics or return cranks. When more than one cylinder is employed, it is common practice to use a common valve to control the events in all cylinders, locating it horizontally on the top or on the side of the cylinder block, and operating it in various ways, such as through bell crank levers or geared cranks. These engines are so well known as to call for no detailed description ; the best-known of the standard designs are the Stuart Turner "Star," "Sun" and "Sirius" engines, which are well-tried favourites among model engineers. It would appear that the nearest approach to a prototype for this form of engine is the Westinghouse high-speed engine which was used for driving generators in the early days of electric supply ; and it is of interest to observe in passing that the "Sirius" engine is now extensively used for driving small auxiliary lighting plants on locomotives and other mobile steam machinery.



The "Spartan" single-acting poppet-valve Uniflow engine

While the horizontal slide valve is as near as possible ideal from the aspect of steam distribution, it is not so good in respect of mechanical operation at high speed, and under extreme working conditions, the valve operating gear is usually the first thing to give trouble. Many constructors of high-speed engines, therefore, have preferred

**Continued from page* 348, "*M.E*," *March* 24, 1949.



Sectional end and side elevations of the "Spartan" Uniflow engine

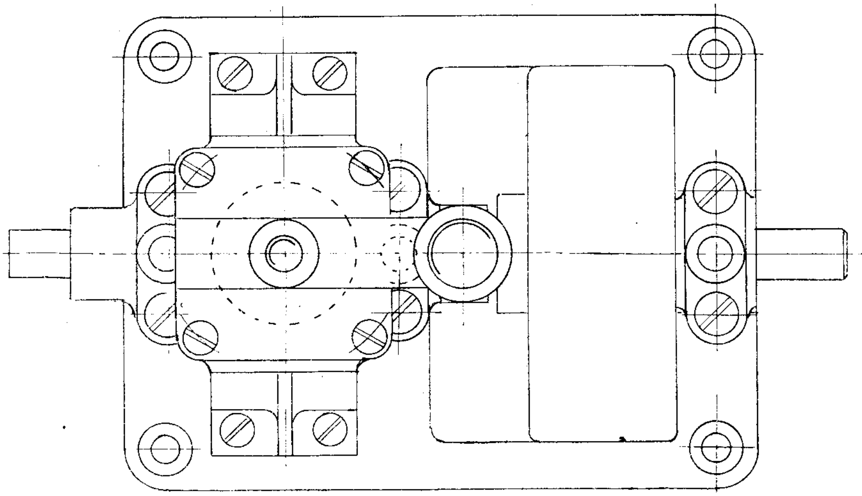
to use slide or piston valves situated vertically and operated directly from the crankshaft. This calls for a separate valve for each cylinder, and a steam distribution manifold, in engines of more than one cylinder, but the valves may be made lighter than the single horizontal valve, and consequently absorb less power in operating them at high speed, Here again, it is hardly necessary to describe such engines in detail, neither is it possible to improve very much on the standard forms, or at least the best examples of them which have been described in THE MODEL ENGINEER in the past.

Other Forms of Valve Gear

While the piston valve is by far the most popular for high-speed engines, several other types of valves are practicable, and may in certain cases offer definite advantage in respect of steam distribution and control, or mechanical operation. The rotary type of valve has been used with success in some cases, particularly in the early flash-steam boats by Mr. H. H. Groves, the engines of which had two horizontal cylinders, served by a single flat-faced rotary valve driven by a bevel-geared shaft from the crankshaft. I consider that for ingenuity, simplicity and lightness, this type of engine has never been surpassed.

Some designers have employed cylindrical rotary valves, or oscillating valves in cylindrical casings. Another type of valve which has had a limited but very successful application in high-speed model engines is the cam-operated poppet valve, comparable to the type of valve used in the orthodox internal combustion engine. When correctly designed, this form of valve offers two outstanding advantages over the slide valve ; it can be timed to give very rapid admission and cut-off at any part of the stroke, and it can be maintained in steam-tight condition better than any other type of valve. For full control of steam and exhaust events, two poppet valves per cylinder are required, such as were used in the highly successful Serpollet steam car in the pioneer days of car racing.

I have made many experiments in the use of poppet valves, and while some of my steam engines to which these have been applied have never progressed beyond the teething stage, I am convinced that they merit much wider attention than they have hitherto received.



Plan view of the "Spartan" engine

The Uniflow Engine

In full-size practice, the Uniflow principle is adopted mainly with a view to economy, which it achieves by virtue of thermal efficiency ; it is not usually a high-speed engine, and one of the essentials in its success is an efficient condensing system. But in model engines, these virtues are not easy to realise in practice, and the principal merit of the Uniflow principle is its simplicity, as applied to a form of engine capable of producing a high power output at high speed.

The true Uniflow engine has no exhaust valve, but only a steam admission valve, which is often of the poppet or "drop" type in full-size practice. Exhaust is effected by a ring of ports in the cylinder wall, uncovered by the piston at the end of the working stroke. On the return of the piston, these ports are closed early in the stroke, and any steam left in the cylinder must be compressed to a much greater extent than in any other type of engine. It will be clear how important it is that all the steam must be extracted from the cylinder while the ports are open, and a high condenser vacuum is a valuable aid in this respect. The steam admission period is usually short, the greater part of the effective stroke being used for expansive working, and with good design, it is possible to obtain, in a single cylinder, an economy equal to that of a triple-expansion engine.

In applying the Uniflow principle to models, many designers have encountered difficulties, mainly, I think, through not taking into account

the very different conditions under which small engines work. The absence of condensing equipment is the most serious discrepancy, making it impossible to reduce the exhaust pressure as low as would be desirable, and under these conditions the high compression near the top of the stroke is a distinct advantage; if it reaches a pressure equal to or approaching that of the steam supply, no steam will enter when the steam admission valve opens, and the engine will refuse to work at all. In many model engines, the Uniflow exhaust ports are used only as an extra outlet to supplement normal exhaust events as controlled by a normal slide valve or other form of valve gear, and this is undoubtedly beneficial in releasing the exhaust quickly, but such engines cannot be described as true Uniflow engines.

It is, however, quite possible to produce successful results in a small Uniflow engine without any auxiliary exhaust valve, providing that some compromise is made in the design. The very small cylinder head clearance as used on full-sized engines, for reasons of economy, is clearly impracticable, and it is not generally desirable to use a compression ratio higher than about 3 or 4 to 1 if the engine is to work successfully at moderate steam pressure. Any form of steam admission valve may be used, but if it is desired to take advantage of expansive working, such as can be obtained with early cut-off of the steam supply, the poppet valve seems to offer the best possibilities.

Some small engines have been made which have no valve gear at all in the accepted sense, the steam being admitted by a small spring-loaded ball or mushroom valve in the head, which is pushed open by a pin or tappet on the head of the piston. This principle is used in the tiny CO_2 engines for model aircraft, which obtain their pressure supply from liquefied gas contained in a Sparklet bulb. Such engines will work fairly well if the supply pressure is high enough, as it is in this case, and they run equally well in either direction, but the crude valve timing is not conducive to real economy or efficiency when working on either compressed gas or steam. They are "utility" engines, however, in the sense of doing a specified job with the maximum convenience and simplicity.

The "Spartan" Engine

I have selected this engine as being one of the most straightforward in design of my experimental Uniflow engines. It is a very successful engine in practice, and can be used either with a more or less orthodox form of water-tube or centre-flue boiler, or a flash boiler, but in either case it runs best on thoroughly dry and preferably superheated steam, at pressures not less than 80 lb. per sq. in.

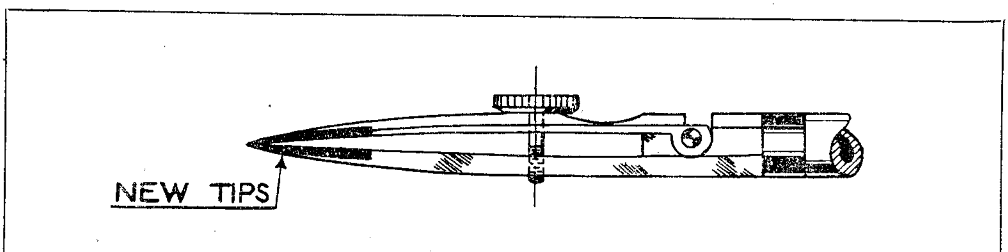
As will be seen from the general arrangement drawing, the engine is of the open type, with overhung crankshaft, and the cylinder is supported on a cast trunk column which embodies the annular passage for the exhaust steam. The steam admission valve is housed in an extension of the cylinder-head casting, and is operated by a cam mounted on the crankshaft, through a tappet which slides in a bronze guide cast integral with the inner main bearing. A follower crank is fitted for the purpose of driving a feed pump or other auxiliaries, but this is an optional arrangement, and both the follower and its bearing may be omitted if they are not required. The main structure of the engine may be in light alloy, but the cylinder and piston should be of cast-iron, and the head, with valve guide and seating, either of cast-iron or hard bronze.

I propose to give detail drawings and machining instructions for the construction of this engine, as it involves several features which differ from the normal run of steam engine practice.

(To be continued)

NEW TIPS FOR RULING PENS

by H. H. Nicholls



SOME time ago the writer was able to give a new lease of life to an old drawing pen of the hinged nib type which, after long wear, had become short and thick at the tips.

After softening the existing stubs, a step was filed in each, and pieces of clock spring of suitable gauge were silver-soldered into the steps. The new tips were then trimmed to correct form, and hardened and tempered in the usual way.

When the old nibs are being softened, care must be taken to avoid softening of the springy portion of the nib adjacent to the hinge.

The sketch was drawn with the aid of the pen after it had been renovated as described.

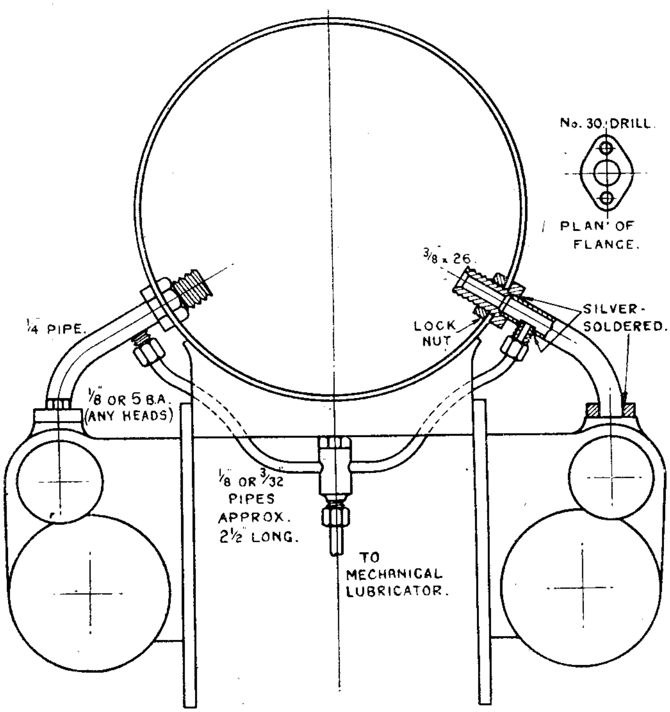
A $3\frac{1}{2}$-in. Gauge L.M.S. Class 5 Loco

by "L.B.S.C."

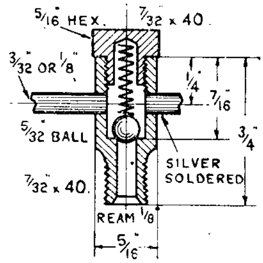
ON the full-sized L.M.S. "Class 5's," the steam-pipes are attached by flanged joints to the superheater header near the ends, pass through the sides of the smokebox at an acute angle, by way of a special fitting, and go straight down to the steam chest flanges. Whilst using the same principle for "Doris," I have simplified matters somewhat, taking the pipes from the superheater header to a couple of unions, the screwed parts of which project through the smokebox shell at right-angles to same, making it easy to connect up. A curved pipe is attached to each union screw outside the smokebox, and carries an oval flange on the lower end, which is bolted to the flat seating on top of the steam chest. Oil is introduced into the steam flow *via* a small union on each pipe. These unions are connected to a central oil check valve, which is in turn connected to the mechanical lubricator. The whole bag of tricks is shown clearly in the reproduced illustration.

The first need will be a couple of flanges for attachment to the seatings on the steam-chest; these are cut from $\frac{1}{8}$-in. sheet brass, or castings may, of course, be used if available. They are drilled No. 30 for fixing screws, and $\frac{1}{4}$ in. drive fit (letter D drill, if you have it, or 6 mm. would do) for the steam pipes. Face the contact side by rubbing on a smooth flat file.

The union screws are made from $\frac{7}{16}$-in. hexagon brass rod. Chuck in three-jaw; face, centre deeply, and drill $\frac{3}{16}$-in. for about $\frac{3}{4}$ in. depth. Turn down $\frac{1}{2}$ in. of the outside to $\frac{3}{8}$ in. diameter, and screw $\frac{3}{8}$ in. by 26. Part off $\frac{1}{8}$ in. behind the shoulder. Reverse in chuck, and open out to $\frac{1}{8}$ in. drive fit for $\frac{1}{8}$ in. depth. Chamfer the corners of the hexagon. The union screws for the oil connections are made exactly the same as the nipple in the side of the check valve under the lubricator, so there is no need for repetition of ritual.



Steam and oil connections for "Doris"



Oil check-valve

Directly above the centres of the seatings on top of the steam chests, and approximately $\frac{7}{16}$ in. above the edge of the flange of the smokebox saddle, drill a $\frac{1}{8}$-in. pilot hole each side, and open them out with a $\frac{3}{8}$-in. clearing drill; letter W if you have it, if not, use 25/64 in. Make a couple of $\frac{3}{8}$-in. by 26 locknuts from $\frac{7}{16}$-in. brass rod, $\frac{1}{8}$ in. thick; I don't have to detail that simple job. Poke one of the union screws through the hole in the smokebox, and put the nut temporarily inside; also put the oval flange temporarily in place on the steam-chest. Bend a bit of $\frac{1}{4}$-in. copper tube to the shape shown in the illustration, and of a length that will just enter both the union

and the flange ; then bend a similar piece for the opposite side. On the inner side of the bend, drill the pipe for the oil nipple (see illustration for approximate location) and fit same. The whole lot, flanges, main unions, and oil nipples, can then be silver-soldered at one heat. Pickle, wash off, and clean up ; then drill a $\frac{5}{16}$-in. hole in the side of the smokebox saddle directly below the holes in the smokebox, after which the steam-pipes can be erected. Put a 1/64 in. Hallite or similar gasket between flange and seating on the steam chest, and use $\frac{1}{8}$-in. or 5-B.A. screws to hold down the flange. Any heads will do, as the whole lot is hidden by the casing, when same is fitted later on. A good smear of plumber's jointing, put around the threads of the union screw close to the shoulder, will effectually seal any air leak ; a few strands of asbestos may be wound around inside if desired, before tightening the locknut. Before screwing home the union nuts on the pipes coming from the superheater header, wipe off any superfluous jointing. You don't need it on unions, it only makes them hard to undo when required.

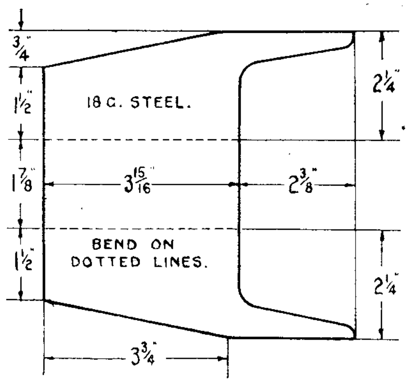
Oil Connections

Make up a small spring-loaded check valve, as shown in the illustration, from $\frac{5}{16}$-in. brass rod. The seating, ball fitting, union end, and cap, are all made as previously described for the clacks under the lubricators ; but instead of a screwed fitting, or a union nipple in the side, silver-solder in two pieces of 3/32-in. copper tube, or $\frac{1}{8}$-in. if you have nothing smaller. These should be approximately $2\frac{1}{2}$ in. long. and the outer ends are furnished with union nuts and cones, to match the nipples on the steam-pipes. Note, it is very important that both these pipes should be exactly the same length, otherwise one cylinder will get more oil than the other. The oil will naturally take the path of least resistance. Bend the pipes to the shape shown—you needn't bother to be too exact —wangle the nuts through the $\frac{5}{16}$-in. holes in the saddle, and connect them to their respective nipples on the steam-pipes. The union at the bottom of the check valve is connected to its mate under the lubricator, by a piece of 3/32-in. or $\frac{1}{8}$-in. copper tube, furnished with the necessary union nuts and cones at each end. No separate support is needed for the valve ; the pipes will hold it quite well.

Grate and Ashpan

The grate and ashpan for this engine are very similar to those I specified for the "Minx," owing to the presence of the trailing coupled axle under the firebox. On a $2\frac{1}{2}$-in. gauge engine, there would have been no difficulty in using a full-length inverted-channel ashpan, with a couple of slots in the side for allowing the axle to clear ; but this type is only suitable for use with a separate grate having extended bearers fitting into nicks in the bottom of the firebox side sheets, and the engine has to be turned over, to reinstate the grate and ashpan after the fire has been dumped. Although "Doris" isn't such a hefty lump as the "Minx," she is still too much of a "two-ton-Tessie" to be turned upside down with impunity. Hence the arrangement shown, which can be replaced with the engine standing over the ash-pit.

The grate can be either cast, or built up. If the latter, you'll need seven lengths of $\frac{1}{8}$-in. by $\frac{5}{16}$-in. commercial black strip steel, each a full $6\frac{1}{4}$ in. long. These are cut, bent, drilled, and assembled exactly as described for the 5-in. gauge engines. The spacers are made from $\frac{5}{16}$-in. round rod, drilled No. 20 for the 5/32-in. bearers. Incidentally these bearers would be more lasting if made from rustless steel, not for any "fancy" purpose, but simply because it is more resistant to burning than ordinary steel, and also does not rust away when condensation takes place in the firebox after the engine has been standing cold for any length of time.

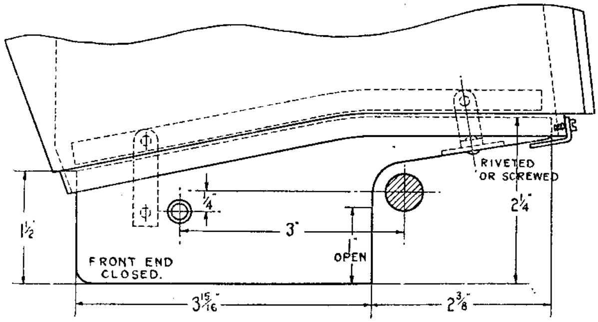


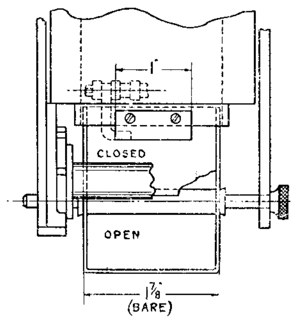
Ashpan "in the flat"

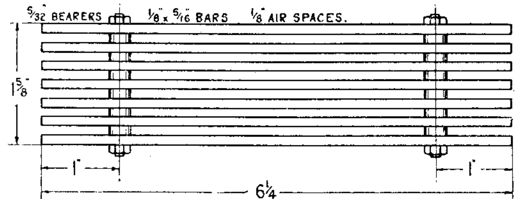
The front legs are splayed out to meet the sides of the ashpan, same as "Minx," but the back legs are made angle-shape, with the angles at the bottom, and pointing toward each other, as they are too short to bend outwards for riveting to the side of the ashpan. Instead, they can be set at an angle to the firebars, as shown in the illustration, so that they will rest on the sloping part of the ashpan, to the rear of the trailing coupled axle. They can be attached either by rivets, or screws put through clearing holes in the ashpan, into tapped holes in the feet.

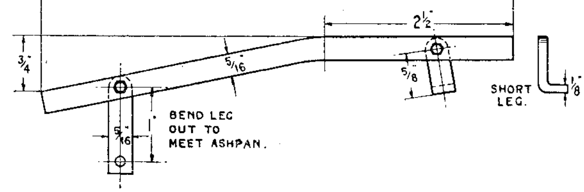
The ashpan itself is made up exactly as described for the "Minx." Ordinary blue sheet steel of 18-gauge is plenty thick enough. A piece approximately $6\frac{3}{8}$ in. long and $6\frac{3}{8}$ in. wide will be needed, and this is marked out as shown in the diagram. Cut away the unwanted parts, and bend up the residue to a channel shape, which should be a bare $1\frac{7}{8}$ in. wide at the open top so that it will fit easily between the side plates of the firebox. I have shown the front bottom corner rounded, as on the old Brighton engines, but it may be left square if desired. On the full-sized "Class 5's," there is a damper door here, but it isn't advisable to fit one on the little engine, as ashes and grit will blow out of it and get all over the motion. There is a bit of a difference between the distances between ashpan and moving parts, in 4-ft. $8\frac{1}{2}$-in. gauge size, and $3\frac{1}{2}$-in. gauge ! Close the front end with a piece of 18-gauge steel

brazed into position; or if you prefer, cut the piece wide enough to allow $\frac{1}{4}$ in. or so being bent at right-angles each side, and riveted to the sides of the ashpan. Same applies to the sloping piece over the axle at the rear end. Personally, I prefer brazing or Sifbronzing. A gap 1 in. deep is left between the bottom of the ashpan and the lower edge of the curved piece over the axle, as shown in the illustrations. This should be all right for Welsh or anthracite coal; but for North Country steam coal it may be necessary to drill a few holes in the curved plate. This, however, will be a matter for actual experiment when the engine takes the road. If the fire burns dull under the door, the holes will be needed.









Grate and ashpan for "Doris"

How to Fix the Grate

The grate is made a permanent fixture in the ashpan, in a manner similar to that of the "Minx"; the bottom edge of the bars should be approximately $\frac{1}{8}$ in. above the upper edge of the ashpan. The front legs of the grate are splayed out and riveted to the sides of the ashpan. The back legs are set back until the angles or feet at the bottom are fair and square with the sloping plate, as shown by the dotted lines in the illustration of the complete assembly, and are secured by screws or rivets as previously mentioned.

The whole bag of tricks can now be erected on the engine. At 3 in. ahead of the trailing axle centre, and $\frac{1}{4}$ in. below level of same in running position, drill a $\frac{3}{16}$-in. clearing hole through the frame at each side of the engine; use No. 11 drill. Bend up a little bracket from a piece of 18-gauge steel 1 in. long, the vertical part being about $\frac{3}{8}$ in. and the horizontal part about $\frac{1}{2}$ in. wide; attach this to the bottom of the firebox door-plate by a couple of $\frac{1}{8}$-in. or 5-B.A. screws. Stand the engine on a piece of line without cross-sleepers (like the pits in the loco. sheds) and insert the back end of the ashpan into the firebox ahead of the rear axle, pushing it over same, until it drops back and rests on the bracket, allowing the front end to just enter the firebox. Prop up the ashpan until level, then poke the No. 11 drill through the holes in the frames, holding the brace level and square, and drill corresponding holes in the ashpan. Remove ashpan, open the holes to $\frac{5}{16}$ in., and fit a tube and pin exactly as described for the "Minx."

You are now ready for your first trial run—*what* a day!—and the same general instructions as given last week, apply to the $3\frac{1}{2}$-in. gauge engine, so go right ahead, good luck, and mind young "Doris" doesn't run away with you; she is quite capable of it! Just one point; she has piston valves, whilst the "Maid" and "Minx" have slides, so don't on any account forget to open the cylinder drain cocks before starting off from cold, and don't close them until the cylinders are thoroughly hot, and water has

ceased to issue from the cocks. Give the lubricator wheel a few turns by hand, to ensure that the valves start with lots of oil. Once the oil film between piston-valves and liners is established, the lubricator will maintain it, and the top of the chimney should always show signs of oiliness, an indication that all is well down below. As long as the film *is* maintained, wear will be negligible, as the metal surfaces never actually come in contact; also, as the film forms a seal, wheezing and blowing should be entirely absent.

Passing Thoughts About Tractive Effort

I haven't the foggiest notion who wrote the paragraph about tractive effort, in the "Smoke Rings" columns in the issue for February 24th last, so don't run away with the idea that I am trying to "pull a fast one" on anybody in particular; but certain statements made in it, seem to call for a little analysis and elaboration. Let us therefore expound!

The statement that "theoretically, a locomotive on a straight track with dry rails should be able to move a load equal to one hundred times its drawbar pull" means exactly nothing at all, for it entirely ignores THE vital factors, bearing and flange friction. If you don't believe me, ask any full-sized driver. He will tell you that some coaches run free, and the engine can play with a dozen of them, whilst others run as stiff as—ah, um! I'd better not report that verbatim—and he wonders if the axleboxes have been filled up with golden syrup in mistake for oil Just shut off to stop—you don't need any brakes! The same thing applies in the small size. If your passengers can spread their weight evenly over the cars, so that flange friction is reduced to the minimum, and the cars themselves have perfectly-turned wheels running on self-aligning double-row ball-bearing axles, the engine will pull an amazing load.

Now couple the same engine to a rough car consisting of a bit of plank, with four roughly-turned or worn wheels, with axles running in plain plummer-block bearings, out of alignment; sit your passenger toward one corner, so that about 75 per cent. of the load comes over one wheel, and forces its flange hard against the rail head. See what happens; even if the engine is able to start the load, she will only just crawl with it. Where has the 100 to 1 tractive effort gone? Just mopped up in flange and bearing friction.

A load of twelve times its own weight, on decently-constructed cars, should be a minimum, not a maximum, for any self-respecting little steam locomotive worthy of its name and traditions. The very first time I steamed "Tugboat Annie," during the war period, one afternoon when Jerry wasn't womming around, I put three cars behind her, using old "Ayesha's" tender because she hadn't one of her own. On those cars were five hefty adults; three of them officials of the Coulsdon and Purley U.D. Council, one of the lorry drivers, and myself, which totted up to just over fourteen times her own weight, as she was then in her unfinished state. "Annie" started that little lot without slipping, and rapidly attained a speed which gave my passengers all the excitement they wanted in staying on the cars going around the curves; she was running notched up to kicking point, and a little over half regulator. Had I let her all out, we should have been in the ditch!

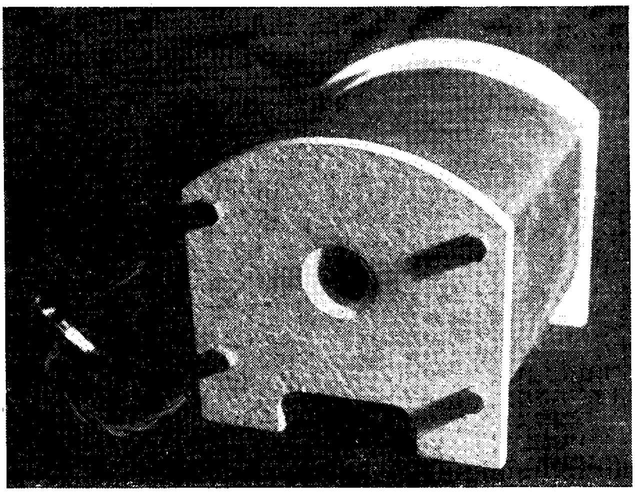
My old single-wheeler "Ancient Lights" weighs 18 lb. in working order. On the occasion referred to, in the issue mentioned above, she was doing her best to run away with a load of $11\frac{1}{2}$ times her own weight, with only three-quarters of her power available, owing to the sheared crosshead pin. She makes easy work of myself and a six-stone child, a load equal to fourteen times her own weight, and she would be off the road at the curves if I let her go. This from a poor old cat over 60 years of age!

My little $2\frac{1}{2}$-in. gauge Carson "Precursor," weighs 16 lb. only, but will haul two 10-stone adults at a high speed; this is equal to eighteen times its own weight, and it isn't "all-out," at that. True, it has one of my own boilers, and my own valve-gear and setting. Old "Ayesha" weighs 19 lb. and if you had seen what she did with the combined load of our advertisement manager and myself, you would have been excused for wondering if she really had any load or speed limit, despite her 27 odd years of service. Forgive me if I remind beginners that she was the engine that "started it all." I would also remind them that the locomotives referred to above, are simple two-cylinder engines, either single-wheeled or four coupled; *not* three- or four-cylinder jobs with six or more coupled wheels, with large boilers to match. They were not built for super-haulage; merely as representative express passenger engines, whose full-size sisters aim at high speed rather than great power. It is when we come to locomotives that really are intended for "shifting the load," that the haulage capacity becomes astounding. My $2\frac{1}{2}$-in. gauge 2-6-6-4 Mallet "Annabel" thinks nothing at all of starting six heavy adults from a dead stand, on a grade of 1 in 70, and what she can shift on the level, has never yet been ascertained, as so far sufficient cars have not been available. As to the speed she can travel at, well, you had better ask Driver L. A. Earl, late of the L.M.S., about that!

Another engine that loves an outsize in loads is my old "Caterpillar" goods engine, four-cylinder eight-beat 4-12-2, built in 1926 in 43 days. She is only $2\frac{1}{2}$-in. gauge, but at the Model Railway Club Exhibition that year she took her turn with engines twice her size, hauling 10-passenger loads; and once, at a friend's place in Birmingham, she hauled a load of 16 mixed adults and children, seated on a plank supported by two eight-wheel cars. The above instances are not intended as any "hot air," merely statements of fact for which I can vouch, and check weights and figures; but nearly every week I receive letters from delighted builders of locomotives described in these notes, giving details of deeds of prowess. To give just one example, a $2\frac{1}{2}$-in. gauge "Austere Ada" did the whole of the passenger-hauling at a provincial club exhibition, for two days, taking six adults at a time, and finishing as fresh as the proverbial spring daisy. A little engine that won't pull *at least* twelve times its own weight, with cars of reasonably good workmanship, needs a little kind attention!

Trade Topics

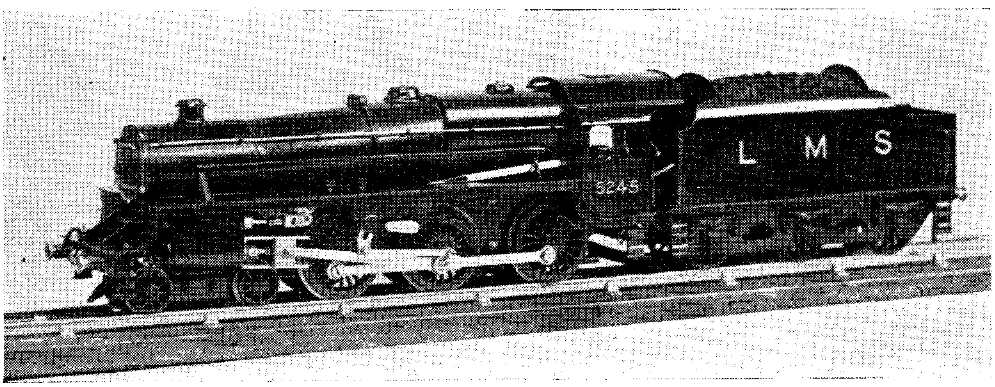
A New Miniature Electric Furnace



MESSRS. R A. Girdlestone Ltd., 15, St. Nicholas Street, Ipswich, have sent us particulars of a small electric resistance furnace specially designed to suit the requirements of the engineer in respect of heat-treating small tools. This has a tubular muffle with internal dimensions 1 in. dia. by 3 in. long, and will produce a maximum temperature of 1,000 deg. C. on a current of 0.8 amps. at 230-250 volts, which represents a consumption of approximately 200 watts. When once the furnace has attained working temperature, small tools of about $\frac{1}{4}$ in. or $\frac{5}{16}$ in. dia. may be heated to 900 deg. C. in three to four minutes. An earthing terminal is provided on the casing of the furnace, but if the latter is used on the lighting supply this need not be used. Spares for the furnace, including new elements, casing components, insulation, and terminal block are obtainable, and the prices of these, and also the complete furnace equipped with supply lead 6 ft. in length, are moderate, and may be obtained on application.

Steam Locomotive for "O" Gauge

In our issue for February 10th last, we published a notice referring to Mr. N. Dewhirst's blueprints for the construction of a 4-6-0 type steam-driven locomotive for "O" gauge. We now reproduce a photograph of one of these little engines, and we are able to state once more, that this engine, which is built exactly in accordance with the design and specification incorporated in the blueprints, has hauled her builder, thereby proving the possibilities of the design. The photograph shows that the chief characteristics of the prototype are well represented and in very good proportion, in spite of the small size. Readers who are interested in "O" gauge steam locomotives which really look like the prototypes should communicate with Mr. Dewhirst, 46, Crescent Road, Great Baddow, Chelmsford Essex.



PRACTICAL LETTERS

Index Dials

DEAR SIR,—*Re* Mr. A. R. Webb's letter in the March 3rd issue commenting on my article concerning making an index dial for a 12 t.p.i. cross slide feed screw.

Whilst complimenting Mr. Webb on noting these details, I must apologise for not stating that the figure arrived at, i.e., 0.2499 in. was a recurring decimal, but I took it for granted that anyone working out these figures would arrive at this obvious conclusion.

Further, my quotation, "on trying the dial mounted up on the feed screw, it was found that no error was apparent," was not intended to refer to any mathematical conclusions, but to the fact that no error had crept in due to a possible error in the pitch of the knurling wheel, coupled with a possible error arising during knurling. Added to this, no allowance had been made for *depth* of knurl, as all dimensions had been based on outside diameters. Not being aware to what accuracy knurling wheels are manufactured (maybe some kind friend could enlighten us?) I took a chance, hence my remark as quoted above.

Yours faithfully,
Staines. R. F. SLADE.

Soft-soldering

DEAR SIR,—In reply to Mr. D. Nicholson's comments on my article on soft-soldering "M.E.," January 6th), the nipple shown in Fig. 9 is quite suitable for fixing to the pipe when the design calls for it. Thousands were used in this way on aero engines during the late war. No doubt Mr. Nicholson's experiences lay in other directions and I am fully aware of the type of joint he refers to; they have a habit of working off the pipe when subjected to frost, much to the disgust of many householders.

Evidently Mr. Nicholson did not read my article very thoroughly or he would have seen that I did not recommend cored solder for "all and sundry jobs that come along which the handyman may be called to do." I distinctly recommend multi-cored solder for model-making and only on easy metals, e.g. mild-steel, tinplate, brass and copper, and I also stated that special fluxes are needed for the more difficult metals such as stainless-steel, cast-iron, and phosphor-bronze.

I fully realise that if Mr. Nicholson has been trained by the "old school," he may have some difficulty in mastering the modern technique employed when using an electric soldering iron, and cored solders. No doubt his experience with this method was marred through not pre-heating the parts, a point which is emphasised in the article.

Finally, the practice of dipping a hot electric soldering iron in an acid flux every time it is used is very bad practice, and this action is strongly disapproved of by the makers of such irons. In recommending this practice, Mr. Nicholson either does not know this, or he forgot, when he was writing his letter, that I recommended using an electric iron. I have used a 2 lb. solid-type soldering iron for eight hours a day on jobs where even Baker's fluid was not strong enough, but I think when model making, acid fluxes should only be used on rare occasions, as they are dangerous, dirty and corrosive.

Yours faithfully,
Derby. J. W. TOMLINSON.

The "Eureka" Electric Clock

DEAR SIR,—With reference to "Artificer's" articles on the above subject, may I shed some light on the use of poise screws?

These are essential when a bimetal balance is used. Their function is not the correction of position errors—except in the rare cases when it is necessary to put a watch balance out of poise—but the correction of temperature errors on cut balances.

When a gaining rate in heat has to be corrected the weight at the free ends of balance rims is increased. In watch practice this is carried out by moving a pair of screws nearer the free ends.

In the case of the "Eureka" clock the same effect can be obtained by adjusting by unscrewing, the poise screws at the free ends of rim.

It should be noted that the screws from the fixed end to approx. the mid-position have little or no effect on temperature compensation but may be used as an adjustment for mean time.

Yours faithfully,
Cardiff. "WATCHMAKER."

DEAR SIR,—May I congratulate "Artificer" on his "Eureka" clock articles and express the hope that we may have further contributions on horology.

May I draw attention to what I imagine is an error in dimensioning the screw thread on the poise screws.

These are stated to be 0-B.A. but a glance at the photograph on page 125 would indicate that these should be much smaller, either 2- or 3-B.A.

I should also like to suggest that the annular groove in these screws was for the purpose of lightening them and not for ballasting, as this recessing is a standard practice in watchmaking when poise screws are to be lightened.

I think that the most difficult part will be the hairspring, as it would appear that the specified thickness is above the usual range of watch main springs and also the length required.

They could, of course, be made to special order, and I am wondering if it would be possible for you to induce some manufacturer to produce a supply, as the cost of single ones would be high.

Yours faithfully,
Letchworth. A. E. BOWYER-LOWE.

[There is no mistake in the dimensions of the poise screws as actually fitted to the particular specimen of the "Eureka" clock illustrated. It is fully agreed that much smaller shanked screws would be permissible, but those fitted to the clock balance are definitely 0-B.A.—"ARTIFICER."]

Metric Measurements

DEAR SIR,—The letter from Mr. Macauley, March 10th issue, regarding accurate measurements, etc., has prompted the following remarks. I think many engineers would appreciate how to get that " odd 0.007 in." with only a rule. Personally, I have found in accurate marking-out, with dividers, for example, that the intelligent use of the fractional rule, 1/32 in. × 1/48 in., etc., and decimal conversions, often gives nearer " approximations " of decimal sizes than the decimal rule itself, i.e., rule marked in 1/10 in. and 1/100 in. By coincidence, Mr. Webb's letter in March 3rd issue referring to Mr. Slade's lathe index dial, shows up the fallacy of always assuming that by working with decimals one is working to a finer degree of accuracy than when using simple fractions. If Mr. Slade had used 83 1/3 instead of 0.0833, the 250 divisions would have been apparent instantly, and exactly! Concerning graduations, my own lathe is fitted with a 12-thread leadscrew and some years ago I decided to fit an index dial. My choice of divisions was 84 for the following main reasons :

(1) Graduating 84 is easier than 83.
(2) One division equals a " small thou.," which, theoretically, gives a safety margin on diameters turned.
(3) By using the " quarter turn spacings," i.e., index marks 0, 21, 42, 63, I am able to get fractional movements exactly. This latter by remembering that 3/48 in. = $\frac{1}{16}$ in., etc.

My term " small thou." is intentional, to draw attention to the fact that no ordinary small lathe screw is exact in pitch. Therefore, the difference in one division on the index dial, between say, 83 and 84 or (83 1/3) spaces, on the small dials usually made, has no measurable error on the work produced by the average model engineer.

Yours faithfully,

Horwich. W. H. BALSHAW.

Mill Engines

DEAR SIR,—I have been a reader of your journal almost from its first volume. I am also a mill engineer by profession, and I read with interest the article by Mr. A. J. Pengelly in your issue of January 27th, 1949. He gave us some interesting details of mill engines, but some of them far exceed the size he mentions, and as he says it is indeed a treat to see them running. I am glad they will not die out in my time, and if some of our young model engineers will copy some of them to scale, they will be doing a splendid work for the coming generations, to see the grand engineering work of their forefathers. The engines in my charge, are indeed a good example of a modern steam plant. They were installed in 1906, when the mill was built by Buckley & Taylors of Oldham. 2,000 h.p., 24 ft. flywheel weighing 60 tons, 5 ft. stroke, 68 revs. per min., driving 36 ropes, although the wheel has grooves for 44 ropes. The ropes travel at about 5,400 ft. per min.

If any model engineers in the Oldham, Rochdale and Manchester districts wish to see this engine at work, I shall be pleased to show them round ; all who are interested please note address.

MR. E. CRAGG, Engineer,
Roy Mill (1919) Ltd.,
Royton, Lancs.

CLUB ANNOUNCEMENTS

South London Model Engineering Society

The A.G.M. will be held on Sunday, April 10th, at Kings College Hospital Sports Ground, Dog Kennel Hill, East Dulwich, S.E., at 11 a.m.

All members should make every effort to attend, all officers will be elected and there are several very important matters to be settled.

Hon. Secretary: W. R. COOK, 103, Engleheart Road, Catford, S.E.6.

Newton Abbot and District Model Engineering Society

The above society has been very busy lately, and the present time is likely to be looked back on as a very eventful period in the life of the society.

First, plans for the society's 5-in. gauge passenger-hauling railway are proceeding apace. The Newton Abbot U.D.C. have very generously granted us the use of a fine large enclosure, already concreted, in which to construct our track, and we have also permission to erect a club house and workshop. The necessary surveying has been carried out by our track superintendent, Mr. S. Haydon, assisted by Messrs. Knell, Curtiss and West. Incidentally, this work was facilitated by the use of a theodolite constructed by Mr. Curtiss out of an *ex*-R.A.F. direction finder. The building of the locomotive " Minx " is being pursued with considerable enthusiasm.

Secondly, plans for our next exhibition (July 4th to 10th inclusive) are in hand, and every effort is being made to plan this as something really big. There is much yet to be done, but there is little doubt that the exhibition will be a most attractive one, and will arouse considerable interest.

On February 26th the society visited the Newton Abbot Power Station of the British Electricity Authority and three enjoyable hours were spent there. The visit was preceded by talks by Secretary Knell and Mr. J. Curtiss, and these were most interesting and greatly assisted an understanding of the intricacies of a modern power house.

At our meeting on March 4th we had another interesting talk. This time the subject was " The G.P.O. System " and the speaker was Mr. S. West.

It will be seen that the society is extremely active and an excellent future programme is being arranged. Prospective new members or any interested are invited to communicate with the Hon. Secretary, D. KNELL, 9B, Pinewood Road, Milber, Newton Abbot.

Bournville Model Yacht and Power Boat Club

The proceedings at the recent annual meeting were opened by our president, Mr. P. S. Cadbury, before a good muster of members.

A. H. Harlow, the hon. secretary, gave a report of considerable activity during the year ended, mentioning that we had been represented in national sailing events and that the power boat section won all the trophies obtainable at Coventry regatta. The flag station had been painted by members, and the club during 1948 had attained its jubilee. Special reference was made to the beautiful trophy presented by Mr. D. W. Collier for 15-c.c. hydroplane highest speed. (It was designed by Mr. Harlow.) A trophy for the best power boat performance of the year had been presented to Mr. K. Williams.

Mr. T. Dalziel, the power boat captain, said that the highlight was the Whitsuntide regatta which attracted competitors from all over the country. The chairman of the Association of Great Britain, Mr. E. T. Westbury, was present. Two days later the B.B.C. broadcast to the nation a recording of the regattas.

The club are desirous of increasing works and estate members. Applications to be sent to the Hon. Secretary, Bournville Model Yacht and Power Boat Club, c/o Cadbury Bros. Ltd., Bournville.